THE

AMERICAN NATURALIST.

Vol. VI.—NOVEMBER, 1872.—No. 11.

NOTES ON ABORIGINAL RELICS KNOWN AS "PLUMMETS."

BY JOHN G. HENDERSON.

At various points in the United States from the Atlantic Ocean to the Pacific, the curious aboriginal relics which form the subject of this paper have been found. In the absence of any other name for them they have been generally designated as "Plummets," a name suggested by their similarity to the implements of that name, used by civilized man, for the purpose of determining perpendicular and horizontal lines. They are made of copper, stone and iron ore, and are found both upon the surface of the ground and at various depths in the earth, sometimes as many as thirty feet below the surface. They have been found in the mounds of Ohio, at the foot of the "Bluffs" of the Mississippi in apparently undisturbed drift clay, and in the auriferous deposits of Table Mountain, California.

A singular almond-shaped flint implement, found among the other relics of art of the mound builders, for a long time puzzled archæologists, but at length the problem was solved by finding a number of them in an Ohio mound, lying side by side, indicating that by having strips of wood securely fastened on each side, they had once formed part of a sword-like weapon, like what was found in the hands of the natives when Cortez landed in Mexico, and proved so effective, that a man could be cut in two with

it, or a horse killed at a single blow. It is described as a "two-handed staff, about three feet and a half long, in which at regular distances, were inserted transversely, sharp blades of *itzli* (obsidian)." Some accidental discovery of this kind may sometime indicate to us the use of these strange "plummet" implements, wrought with so much care, and bearing such a striking similarity to each other, whether found in the débris of the mountains of California, the mounds of Ohio, or on the banks of the Mississippi. In the meantime we can only speculate upon the uses made of them, and in this paper I propose to enumerate, describe and figure some of them, show the circumstances under which they were found and offer some conjectures upon their uses.

Fig. 132 represents what may be styled the typical form of these implements. It is made of iron ore, ground down and polished, until it is almost as smooth as glass. It is one of eight found by Henry Root, Esq., of Quincy, Illinois. "They were found two miles north of Quincy, at the foot of the Mississippi Bluff, about two feet from the surface, embedded in solid clay. Two were found in digging one post hole, and six others within a few feet." The one figured * above is in my possession, another one of the same number very much like it, is deposited in the State Geological collection at Springfield, Illinois. Prof. Worthen informs me that the iron ore, out of which they were manufactured, was obtained from Iron Mountain in Missouri.

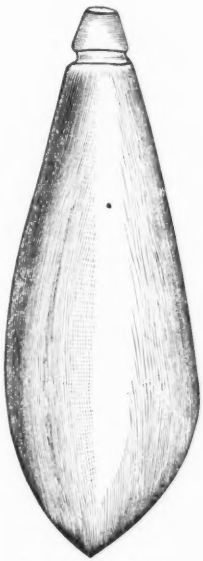
A fragment of one found in Scott County, Illinois, upon the surface of the earth was also made of iron ore. The broken ends are very much worn, as if ground down by hand or by time.

Another one (Fig. 133), having the general shape of figure 132, except that it is much wider in the widest part, was also found on the surface of the earth near the Illinois River in Scott County. The dotted lines are the restoration of the small end, which was broken off. This was found in a field on top of the bluff by Mr. Gardner. Within a mile of where it was picked up is the site of an old Indian village, where pottery, arrow heads, axes, etc., are found. In the burying ground, upon a hill near by, I found traces of funeral ceremonies which were not practised by the Indians of this locality, when discovered by the French in the latter part of the seventeenth century. Upon opening a mound about ten feet in diameter and three feet in height, I found as many as eight

* All the cuts here given are of the exact size of the implements.

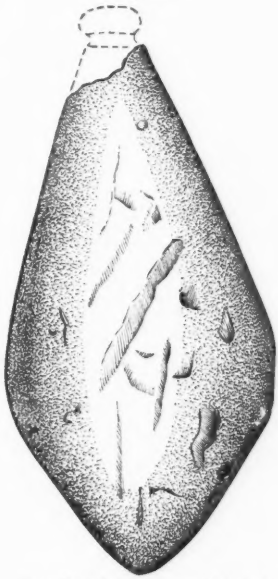
skeletons, all showing distinctly the marks of fire. They were thrown together without any regularity whatever. There were no ashes nor cinders in the mound, which led me to believe that the bodies had been burned near by and the charred remains thrown upon the tomb of the person whose remains were found below them. The bones of this single individual were found at the base of the mound. He (or rather she, for from the skull I judge that it was a female) was buried originally in a sitting

Fig. 132.



Iron Ore (natural size).

Fig. 133.



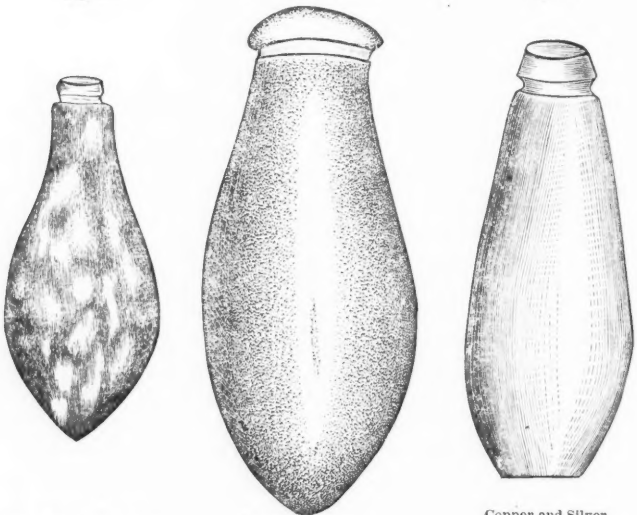
Gray Crinoidal Limestone (nat. size).

posture, but the weight of the superincumbent earth had forced or crowded the vertebræ of the neck into the bifurcation of the lower jaw, and had twisted the head down to one side, so that when found the skull was resting on its side with the face to the east. A skull remarkably flattened by artificial means, or distorted, was found, similar to that of the Peruvian Child, plate No. 10, of Dr. Morton's "Crania Americana." We here see evidence of two practices, that of sacrificing the living upon the

grave of the dead, and the distortion of the skull, both of which were common among the Natchez and other tribes upon the lower Mississippi, but neither of which was practised by tribes living upon the banks of the Upper Mississippi, since its discovery. Whether the "plummet" found near their village belonged to them, or to some older population, can only be a matter of conjecture. The implement is made of a whitish limestone containing numerous small joints of Crinoids.

A much smaller implement, but evidently used for the same purpose (Fig. 134), was found *sixteen feet* below the surface of the

Fig. 134. Fig. 135. Fig. 136.



Green-stone (nat. size). Stone (nat. size). Copper and Silver (nat. size).

earth, in Brown County, Illinois. It is made of green stone. With it were found a small stone scraper and a small disk. The locality where it was found was the bed of a ravine which had been filled up by soil washed from higher ground.

The one represented in figure 135 is copied from Schoolcraft's work, Vol. IV, 175. He describes it as "a fisherman's sinker, of the Penacook tribe, accurately wrought in stone."

In a mound at Marietta, Ohio, "near the feet of a skeleton was found a piece of copper (Fig. 136) weighing three ounces (now in

the Museum of the Antiquarian Society of Worcester). From its shape it appears to have been used as a plumb or for an ornament, as near one of the ends is a circular crease or groove for tying a thread; it is round, two inches and a half in length, one inch in diameter at the centre, and half an inch at each end. It is composed of small pieces of native copper pounded together; and in the cracks between the pieces, are stuck several pieces of silver, one nearly the size of a half dime. A piece of ochre or paint, and a piece of iron ore (hematite) which had the appearance of having been partially vitrified (*polished*) were found." "The body of the person here buried was laid upon the surface of the ground, with his face upwards, and his feet pointing to the southwest. From the appearance of several pieces of charcoal and bits of partially burned fossil coal, and the black color of the earth, it would seem that the funeral obsequies had been celebrated by fire; and while the ashes were yet hot and smoking, a circle of flat stones had been laid around and over the body. * * *

"The mound had every appearance of being as old as any in the neighborhood and was, at the first settlement of Marietta, covered with large trees. It seems to have been made for this single personage, as the remains of one skeleton only were discovered. The bones were much decayed, and many of them crumbled to dust on exposure to the air."*

About ten years ago one of these implements was found, under remarkable circumstances, in Woodbridge County, California. From a paper read by Dr. J. W. Foster before the American Association for the Advancement of Science, at Chicago, 1868, I extract the following description. "The workmen after digging *thirty feet below the surface* struck a plummet composed of *sienite*, ground smooth and formed into a double cone, showing that it was suspended by a string and used to determine perpendicular lines. It affords an example of the lapidary's skill superior to anything furnished by the stone age in either continent." The well was sunk by Jeremiah Wood, on the premises of Mr. McNeely. But if the depth in the earth, at which this specimen was found, is calculated to impress us with the great antiquity of these implements, what shall we say of those found in Table Mountain, in the same state? In a paper read by Professor W. P. Blake, before the same meeting of the Association held at Chicago, 1868, we

* Aboriginal Monuments of New York, by E. G. Squier.

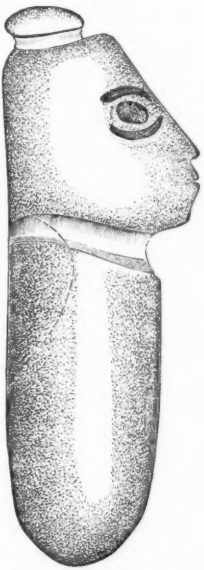
find the following description of the mountain and the relics of art found in it, among which were "some instruments resembling plummets." Where the mountain now stands was a valley traversed by a river. Here ages since, there commenced a deposit with gold, pebbles, mud and sand. Volcanic action encrusted these with ashes, and at last all was covered by the lava. As the valley filled up, the water of the river cut on each side of the accumulating mass a channel commencing at the base of the deposit of lava. In time it washed its way until the Table Mountain stands erect and two valleys are formed, one on either side of it. This mountain extends with its flat summit for miles, its surface edge being a bold bluff of black appearing rock, with little or no vegetation upon its plane. The thickness of the entire deposit averages from one to two hundred feet, the height of the lava above the newly formed valleys being from one thousand to fifteen hundred feet. The miner seeking the auriferous deposit, having, by sinking a shaft, ascertained the greatest depth of the whole deposit, tunnels from the side of the valley, and this process has brought to light teeth of extinct mammalia as well as relics of human art. Among these were two stone objects which were supposed to be shovels used in cooking, by placing them upon or into the burning fuel; a mortar or dish, *some instruments resembling plummets*, and several spear heads."*

In all the specimens thus far described, no effort whatever was made by the artist to modify the form of the implement for the sake of either ornament or novelty, except the Marietta specimen, which had silver worked in the crevices. Whether of stone, copper or iron ore, it consists simply of a double cone, with the bulge nearer the base than top, and a very slight groove around the small end, for the purpose of tying the string by which it was suspended. Not even a line or mark is found upon their smooth polished surfaces, but the following relic (Figs. 137 and 138) is an exception to the above rule. The profile is neatly cut as if the artist had worked with a sharp cutting instrument. The vertical occiput, retreating forehead and massive jaws, give to it a strong Indian look, which is increased when viewed in front, and shows that the aboriginal artist was attempting to carve in stone a portrait, or at least, that he had succeeded in presenting the characteristic features of the Red Indian. The streaks of black paint

*AMERICAN NATURALIST, vol. II, p. 388.

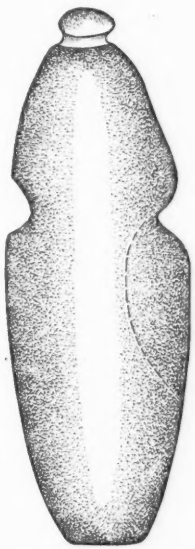
above and below the eyes, the black eye-balls and scalp-lock, give to it a hideous look which, perhaps, caused it to be looked upon with reverential awe by its superstitious aboriginal owner, or the modern Indian who perhaps found it, a relic of some older race, and finished it to his own liking by the addition of the black paint. A glance at fig. 138, which is a back view of fig. 137, shows that the primitive artist preserved as far as the nature of his design would admit, the general plummet form shown in the other implements

Fig. 137.



Dark Limestone (nat. size).

Fig. 138.



Back view of Fig. 137.

figured, while the slight groove around the small end shows plainly that it was to be suspended by a string, and I think fully warrants the conclusion that this implement is but a modification of the plummet, and that they were all used for the same purpose. It was found on the surface near the Illinois river, in Scott County and is now in my possession. Upon the left side a small piece represented by the dotted lines, is broken out and lost. When this is restored as seen in figure 138, the regular oval form of the plummet implements is plainly seen, when viewed from behind.

I can imagine six different uses which *might* have been made of these implements.

1st. They might have been used as sling shots, a string being attached to the weapon and to the wrist, while the implement itself was grasped in the hand. While it would make a very formidable weapon by the addition of weight to the fist, or by holding to the string and striking with it, after the manner of civilized roughs, a war-club would be much more formidable, and would be preferred where there was no motive for concealment; besides, it requires a considerable degree of civilization to invent and fully appreciate the virtues of a sling shot! The Brown County implement (Fig. 134) is evidently too small for anything of this kind, unless, like the little flint arrow points, it was used by the small boys.*

2d. They might have been used as sinkers for fishing tackle. Schoolcraft seems to think that the Penacook implement (Fig. 135) was used by that tribe for this purpose. If this is correct, it does not prove that they were originally intended for that purpose. I myself, by casting, made of lead an exact counterpart of fig. 132, and used it for a sinker for a trout line, and it answered the purpose admirably. I did not try the original implement, because of the danger of losing it, the smallness of the groove rendering it impossible for the fingers of a white man to attach it so firmly to the line as to remove the apprehension of its loss. The amount of labor bestowed on the Marietta, Quincy and Woodbridge specimens, and the inability to fasten them securely to a line, on account of the smallness of the groove, would lead us to believe that they were not used for this purpose.

3d. They might have been used in playing some game, but this is only a possibility. We have no account of any game played by either savage or civilized men (so far as I know) in which any instrument of this kind is, or could be, used.

4th. They might have been used as a sacred implement in the

---

*Since writing the above I have met with the following description of a sling-stone. "The Indians that inhabit still further to the we-twar l, a country which extends to the South Sea, use in fight a war-like instrument that is very uncommon. Having great plenty of horses, they always attack their enemies on horseback, and encumber themselves with no other weapon than a stone of middling size, curiously wrought, which they fasten by a string, about a yard and a half long, to their right arms, a little above the elbow. These stones they conveniently carry in their hands till they reach their enemies, and then swinging them with great dexterity, as they ride full speed, never fail of doing execution."—*Carvers' Travels in North America.* 1776, p. 188.

performance of some religious ceremony. This, like the preceding supposition, is only a possibility, there being no evidence whatever from which we are warranted in deriving such an inference.

5th. They might have been worn as a personal ornament. If they were used for this purpose, it would seem to me that implements worked out of iron ore, with the amount of labor which was bestowed on the Quincy specimens, would be ornamented with lines or figures. Their very plainness would seem to indicate the practical use for which they were intended. Besides, the weight of those made of iron ore would, at least, in the estimation of a white man, render them inconvenient personal ornaments.

6th. They might have been, and probably were, used for plummets. Their shape and the groove at the small end suggest at once, to the eye of a civilized man, that they were used in the first instance for obtaining a perpendicular line, and then as a level by drawing a horizontal line, at right angles with the first. This would easily be accomplished by the use of a wooden or other square. It has been suggested, that from the nature of the aboriginal ruins throughout the United States, the primitive people who made these implements would have had no use for plummets but it seems to me that the fact that this implement can also be used as a level, has escaped attention. Indeed the plummet, suspended to an upright fastened to a horizontal bar, is used among us as a level. That the mound builders had the ability to make the square above suggested, we know from the mathematical accuracy of squares and circular enclosures of earth found everywhere in the Mississippi Valley. Whatever might have been their use, their great antiquity will not be questioned. The Brown County, Woodbridge and Table Mountain specimens indicate that they rank among the very oldest relics of man found upon this continent, while from that found in the mound at Marietta, we see that they were at least not unknown to the mound builders, and, if Schoolcraft is right, the Penacook specimen shows it to have been used by the modern Indian.

[EDITORIAL NOTE. — These "plummets," or "sinkers," as they are more commonly called in New England, are of quite common occurrence in the vicinity of Salem, and we have in the collection of the Academy quite a number of specimens varying in size from an ounce or two to several pounds in weight, but all made on the general pear-shaped pattern, though they exhibit about as many modifications within the shape as shown by the hundreds of varieties of the pear itself. Local archæologists here in general consider them as "sinkers," principally from their shape and from the fact that they are more often found along the seashore than in the interior, though not unfre-

quently met with at a distance from the coast. The very large size of some of the specimens would perhaps indicate some different use from any proposed by Mr. Henderson, and in fact some of them run so decidedly into the group of implements classed as "pestles" that it is almost impossible to draw the line between the two groups, which are well marked by their extremes. The peculiar shape of these instruments has also caused them to be regarded as weights, used to stretch the thread in spinning. This supposition is rendered very probable by the fact that stone weights have been used in spinning, and from the statement (made to me in conversation by Dr. Palmer of Washington, I think) that similar stones are still in use among the Indians of the Northwest. As it is generally accepted that the Mound Builders were informed in regard to the spinning of fibre of some kind, and certainly of the *twisting* of materials which they could manufacture by some process akin to weaving, the use of these implements as weights seems very probable, and as household implements they would often be more or less elaborately finished or carved. For my own part I have for some time considered them as representing, to a greater or less extent, according to size, material, shape and finish, 1st, Pestles, 2d, Sinkers, 3d, Spinning weights, 4th, Ornaments. That their principal use was as "plummets" may be perhaps questioned, as there are far too many of them found, and of too great a variation in size, to lead us to infer that they were used mainly for that purpose. Though if it was necessary, in ancient architecture, to establish a perpendicular line, the implements were at hand as "weights" with lines attached. — F. W. PUTNAM.]

CONTRIBUTIONS TO THE NATURAL HISTORY OF THE VALLEY OF QUITO. — No. III.

BY PROF. JAMES ORTON.

ARTICULATES.

Of crustaceans, the only representative, we believe, is a small cray-fish abounding in the filthy, stagnant waters about Quito; its name is undetermined.

In regard to the character of the insect fauna of the Valley, we quote from a letter addressed by Andrew Murray, Esq., to Dr. Packard. "It is thoroughly Columbian. It would be natural to expect that northern types should run down the Andean chains, at high elevations like Quito; but I have not found the effect to be so much the presence of such types more there than in the rest of the Columbian district (in which they are very largely introduced as I think), as the absence of tropical looking species, which occur lower down in Venezuela, Cayenne, etc. Not that there are not large and gorgeous species, but that the mass seems minute in size and of little brilliancy, but still such genera and forms as are also met with in Columbia itself."

The Valley is not rich in insects, and in this respect is in strong contrast with the Pacific and Napo slopes, where there is no lack of vegetation, heat and moisture. Collectors have generally confined themselves to these prolific regions, so that the Valley has not received the attention it deserves. Still more, they have generally failed to note the vertical and horizontal ranges of the species — important data in illustrating distribution and affinities. A systematic exploration of the equatorial Andes, such as has been given to Amazonia and Central America by Bates, Salvin and Godman, will throw much light on the migration and relation of species and the effect of physical barriers. Messrs. Hewitson, Walker, Butler and Murray have done most towards developing the entomology of the Quitonian highlands. The researches of Bates show that the north-western part of South America constitutes quite a distinct province, having a considerable proportion of species peculiar to itself and a general specific dissimilarity from the adjoining region of Guiano-Amazonia.

The insects of the Valley are not only few in number, but are dull; there is nothing, *e. g.*, to compare with the magnificent beetle *Chrysophora chrysochlora* of Napo, which is on the same line of latitude, but eight thousand feet lower. It would be interesting to know whether the generalization of Bates and Wallace, that coleoptera are brighter near the tropics than at the equator, is truer of the high altitudes than of the lowlands.

It would be premature to draw any geological inferences from our present data, but the change of species seems to show, as Bates observes, that the Columbian highlands (including the Andes of New Granada and Ecuador) were formerly separated from those of Guiana and Mexico.

The following list must be very incomplete.

Hymenoptera.

Bombus funebris Smith.
" robustus Smith.
Apis (sp.?)
Euglossa bombiformis Pack.
Anthophora pilifrons Pack.
Halictus rimosiceps Pack.
Scolia bisignata Pack.
Pompilus vinicolor Pack.
Montezumia Andeus Pack.
Ponera carbonaria Smith.
Augochlora fuscipes Pack.
Xylocopa (sp.?)
Vespa Peruana Sauss.
Hypoclinea ursus Mayr.

Lepidoptera.

Pyrameis carya Hübn.
Anartia amalthea Linn.
Thecla atymna Hew.
Dædalma inconspicua Butler.
Colias Semperi Reak.
Callicore eluina Hew.
Amphirene Epaphus Latr.
Euptychia nossis Hew.
" harmonia Butler.
" tiessa Butler.
" Enyo Butler.
" jesia Butler.
" libya Linn.
Catagramma ceryx Hew.

Eueides eurysacus Hew.
Heterochroa collina Hew.
" ethelda Hew.
Satyrus Orchus Latr.
Hesperia carmenta Hew.
Heliconia hygiana Hew.
Leptalis avonia Hew.
Steroma Andensis Feld.?
" pronophila Feld.?
Devara (?) frigida Walk.
Epilais melda Boisd.
Bombyx mori Linn. (var.?)
Hyperchiria nyctimina Walk.
Eupyra regalis Boisd.
Tephrosia litharia Guen.
Urapteryx politia Cram.
Chœrodes tetragonata Guen.
Clysia succedens Walk.
Heterolocha ruminaria Guen.
Gypsara exularia Walk.
Scordylia unanimaria Walk.
Sybarites leptaliaria Guen.
Mocis notescens Walk.
Amphigonia insana Guen.

Diptera.

Pangonia ocellus Walk.
" testaceiventris Macq.
Tachina transiens Walk.
Tabanus auribarbis Macq.
" Peruvianus Macq.
Pulex irritans Linn.
" penetrans Linn.

Coleoptera.

Oxygonia Vuillefroyi Chaud.
Deltochilum Burmeisteri Har.
Uroxys elongatus Har.
Anomala marginicollis Deyr.
Phanaeus (velutinus Murr. ?)
Chalepus Zoilus Burm.
Golofa (sp.?)
Colinus subviolacra G. and P.
Chalcolepidius limbatus Esch.
Lampyris (sp.?)
Astylus lateralis Buq.
Callichroma velutina Fabr.
Steirastoma brevis Linn.
Elytrosphæra fulminigera Deyr.
Hippodamia (sp.?)
Podischnus Agenor Burm.?
Diabrotica Saundersi Baly.
Tæniotes marmoratus Thom.

Hemiptera.

Pediculus capitis De G.
Coccus cacti Linn.
Rhiginia immarginata Stal.
Tettigonia immaculata Walk.
" longipes Walk.
" stipata Walk.
" plumbea Walk.
" decorata Walk.
Triquetra sobria Walk.
Hoplophora proxima Walk.
Zammara (sp.?)

Orthoptera.

Disceratus nubiger Scudd.
Panacanthus varius Walk.
Phasma (sp.?)

Doubtless many species credited to "Columbia," "New Granada," "Ecuador" and the "Andes of Quito" occur in the Valley; but I have rigidly excluded all such in default of precise localities.* Want of certainty in a given case is indicated by an interrogation point. I have not attempted to eliminate introduced species. The jigger is confined to the lower, sandy localities, as at Ambato. In my ascent of Pichincha, I observed large flies near the summit (fifteen thousand five hundred feet) but am unable to give the name. The spiders, of which a hairy species (*Mygale*) occurs at Quito, are also undetermined.

PLANTS.

While the east and west slopes of the Ecuadorian Andes are covered with a rich, subtropical vegetation, the Valley between the

*Kirby gives a list of 227 Diurnal Lepidoptera from "Ecuador."

Cordilleras, including their synclinal sides, is singularly barren. The birch-grove of Baños and the cinchona wood of Loja furnish the nearest approach to a forest. Herbaceous vegetation predominates over the arboreal. The "plain," or bottom of the Valley, is generally covered with vast quantities of volcanic ashes, mud and trachyte, with little to relieve the dreary landscape but hedges of agave, cactus and heliotrope. The neighborhood of Quito is the most verdant part of the whole basin. The paramos are treeless, rolling steppes on the shoulders of the mountains, having an average elevation of twelve thousand feet, and overgrown with *paja*, a species of Stipa. High up, reaching even to the snow-limit, is the peculiar shrub *chuquiragua*, while the gulleys are sprinkled with rigid tufts of Valeriana, Viola and Geranium. The last zone of vegetation consists chiefly of yellow-flowering *Compositæ*, the ruling order throughout the Valley. Last of all the trees is the Polylepis, reaching the altitude of nearly fourteen thousand feet. The most common tree in the Valley is the "Aliso" (*Betula acuminata*); and the most abundant moss is the *Tayloria erythrodonta*. Flowers are found in Quito all the year round, but the most favorable months are December and May. Yellow and blue are the predominating colors. The higher the altitude the brighter the hues of any given species. Thus, the *Gentiana sedifolia* is a small, light blue flower in the lowlands, but on the Assuay it has bright blue petals three times as large and sensitive.

The following facts noticed by Kerner in a special study of the Tyrolese Alps are observable on the Quitonian Andes: (1) The very small number of annual plants, bearing to perennials the proportion of four to ninety-six, while in the Mediterranean district it is forty-two to fifty-eight. (2) The large proportion of Alpine plants with rosettes of fleshy or succulent leaves, as Gentians, Saxifrages,* etc. (3) The poverty of the Alpine flora in plants having stores of underground nourishment in the form of bulbs. (4) The almost entire absence of climbing and creeping plants. (5)The large proportion of flowers of intense hues. (6) The deficiency of spiny and stinging species.

To this I may add what is characteristic of insulated tablelands as well as oceanic islands, the remarkable absence of large groups of plants; in other words, the great ordinal and generic diversity in proportion to the total number of species. As Hum-

* The *S. Boussingaultii* occurs on Chimborazo at the height of sixteen thousand feet.

boldt says: "The character of the flora of the elevated plateaux of Mexico, New Granada and Quito, of European Russia and of Northern Asia, consists, in my opinion, not so much in the relatively larger number of species presented by one or two natural families, as in the more complicated relations of the coexistence of many families and in the relative numerical value of their species."

The flora of islands and highlands are strikingly akin in their present features and also in their origin. Both resulted from migration, for since the great mountain chains are recent upheavals, evidently our Alpine plants must be only altered forms of lowland species.

The flora of Quito has some bearing on the question of a glacial winter within the tropics. The identity of many plants on mountain summits, separated from each other by hundreds of miles of lowlands where the Alpine species could not possibly exist, is well known. The peaks of the Alps and Pyrenees show a number of plants like those in Lapland, but nowhere found in the intervening plains. The flora of the top of Mount Washington is identical with that of Labrador. Mr. Wallace tells us that the isolated volcano of Pangerango, in Java (which has the same latitude and altitude as Quito), presents a vegetation closely allied to that of Europe, and Forbes has shown that the mollusca of Britain migrated during the ice period into the Mediterranean.

Mr. Darwin has explained these remarkable facts on the theory that as the cold of the glacial epoch came slowly on, and each more southern zone became fitted for arctic beings, and ill fitted for their former more temperate inhabitants, the latter would be supplanted by arctic productions and migrate into the tropics. In the New World it would follow that by the time the cold had reached its maximum, the now temperate regions of the United States would be covered by an arctic flora, while the plants indigenous to the latitude of New York would be driven into Mexico and the Isthmus; — as when our winter creeps down from the north, our summer birds travel southward. As the warmth returned, the arctic forms would retreat northward, while the temperate plants, unable to bear the returning heat of the tropical lowlands, would scatter, — many species returning to their old northern quarters, some of which could not survive the journey, perishing utterly, and others, naturally seizing upon the tropical

mountains, ascending higher and higher as the cold receded, till they found an asylum at the altitude where the climate corresponded with that of the latitude of their native home. As the tide leaves its drift in horizontal lines, so would the living waters leave their living drift in isothermal lines on the mountains of the equator.

If, then, a vast glacier covered North America from the Pacific to the Atlantic, and from the Pole to the Ohio River, or still more southerly, the depression of temperature would be sufficient to allow some temperate plants to sojourn in the Isthmus, and even to reach the equator. We should, therefore, look with some confidence for some remnants of our flora on the highlands of New Granada and Ecuador, or at least for some allied and representative forms. There would, of course, be some stragglers from the south: but, as Hooker has remarked, many more plants have migrated from the north to the south, than in a reversed direction. We have excellent evidence, says Darwin, that the glacial epoch was an enormous age, so that there was time enough for such a migration. Doubtless, there was time also for modification, and some of these wanderers might exist in their new habitat, as new varieties, or even distinct species. Still they would be plainly related to their brethren of the Temperate Zone.

The climate of North America 36° 30′ and northward corresponds to the climate of the equatorial Andes at the altitude of eight thousand feet and upwards. The intervening land of Central America is too low and tropical to allow the passage of temperate plants by ordinary migration. But if this region was turned into a temperate zone in the glacial epoch, the chasm is bridged. Comparing the exogenous flora of the Valley of Quito with that of our Northern States east of the Rocky Mountains and eliminating those species which occur in both localities, but are indigenous to neither, such as chickweed (*Stellaria media*), strawberry (*Fragaria vesca*), goose grass (*Galium aparine*), mudwort (*Limosella tenuifolia*), black night-shade (*Solanum nigrum*), pansy (*Viola tricolor*), and peppermint (*Mentha piperita*), we find the following which are native to the United States, and also occur at Quito:— (1) The bellwort (*Specularia perfoliata*). This is a temperate plant, and would not be likely to endure the transit of the tropics as they now are. We may suppose it was intentionally introduced by the Quitonians, but this is not probable, as it is not

a showy or useful flower; or that it was accidentally conveyed to the valley, which is possible. He who doubts it must believe in a special creation or the glacial theory. (2) The evening primrose (*Œnothera biennis*); but as this is found only in the cultivated parts of the valley, it was doubtless introduced through Europe or down the western coast, as it occurs also in California. (3) The gymnosperm (*Ephedra Americana*) is found by the shores of Great Salt Lake, yet appears to be a native of Quito, though Dr. Torrey doubts their identity. (4) The *Erigeron gnaphalioides* of Gray grows in Texas and about Quito. I know no other species apparently indigenous to Quito and the United States.*

If we take a more general survey, we shall find that the largest order in Quito, as in the United States, is the Compositæ. But here the correspondence ends.

The following list of orders shows their relative importance in the two countries:—

United States.	*Quito Valley.*
1. Compositæ.	1. Compositæ.
2. Leguminosæ.	2. Scrophulariaceæ.
3. Rosaceæ.	3. Labiatæ.
4. Scrophulariaceæ.	4. Leguminosæ.
5. Ranunculaceæ.	5. Cruciferæ.
6. Labiatæ.	6. Rosaceæ.
7. Cruciferæ.	7. Ranunculaceæ.

The Compositæ have one hundred and fifteen genera in the United States, and fifty-six at Quito, nineteen of which are common to both, but no species alike. The Leguminosæ have fifty-four genera in the United States and just half that number in Quito, sixteen being common. The Scrophulariaceæ have thirty-five genera in the United States and fourteen in Quito, half of which are common; Cruciferæ, thirty genera in the United States and eight in Quito, six being common. Solanaceæ, thirteen genera both in the United States and in Quito, four of which are common. There are twenty-three species of Eupatorium in the United States and twenty-four at Quito—all different. Our country is remarkable for its Solidagoes, outnumbering those of any other region; in the whole valley of Quito there is not one.

*It is fair to state that according to Hooker, sixty Arctic American species of phænogamic plants are found on the tropical mountains (probably of Mexico); but it is fair to ask why none of our hardy, diffusible plants—our daisies, thistles and golden rod were pushed across the Isthmus and left on the mountains of the equator. *Trisetum subspicatum* is common to both regions, but occurs also in Tasmania.

The botany of our Pacific states (California and Oregon), so far as it is known, reveals no nearer affinity to that of Quito — although the near relatives of Californian plants, when they have any in other lands, are in the Mexican plateau. Quito has plenty of Bignoniads, Acanthads and Lobelias; on our Pacific slope there are none. In Quito the Compositæ are mainly Heleniæ; on our Pacific coast there are few, if any, Heleniæ, but the order tends chiefly to Senecionidæ.

The recent researches of Griesbach prove the absence of temperate American species or types of plants on the loftier mountains of the West Indian Islands. These rise in Jamaica to eight thousand feet, and yet with the exception of a few naturalized plants, as *Fragaria vesca*, *Ranunculus repens*, etc., we find scarcely any North American temperate genera or species. Of nearly eleven hundred West Indian genera, only thirty are decidedly northern. This almost total absence of typical North American plants in the highlands of the West Indies, is a feature incompatible with their having shared in the effects of a glacial migration.*

[Parts I and II of these "Contributions" are given in Volume V of the NATURALIST, commencing on pages 619 and 693. — EDS.

---

* *Appendix.* The Weasel, *M. aureoventris* Gray, mentioned on p. 622, Vol. v, is probably from the Valley. The following *Birds* should be added to the list given in the NATURALIST, Oct. 1871, Vol. v, p. 625; —

Pheutieus aureoventer Scl.
Tyranniscus nigricapillus Lafr.
Orthoëa citrinifrons Scl.?
Micocerculus gratiosus Scl.?
Leptasthenura andicola Scl.
Stenopsis ruficervix Scl.
Nyctibius Jamaicensis Gm.?
Eutoxeres heterura Gould.
Chlorostilbon melanorhynchus G.
Panoplites Mathewsi Lodd.
Heliangelus micraster Gould.
Cynanthus cyanurus Steph.
" mocoa D. et B.
Phaëthornis yaruqui Boure.
Heliotrypha Parzudakii L. et P.
Petasophora iolata G. et M.
" cyanotis Boure.
Bourcieria torquata Boiss.
Urochroa Bougieri Boure.
Sycalis arvensis *should read* Sycalis luteiventris Mey.

NOTES ON THE VEGETATION OF THE LOWER WABASH VALLEY.

BY ROBERT RIDGWAY.

1. THE FORESTS OF THE BOTTOM LANDS.

That portion of the valley of the Wabash River and its tributaries lying south of latitude about 38° 25′ contains a sylva peculiarly rich, and also remarkable for combining within one area many of the characteristic trees, as well as other plants, of the northern, southern and southwestern portions of the United States, besides supporting the vegetation common to the whole Atlantic region or "Eastern Province." In this section of the country many species of the botanical districts named, in receding from their several centres of abundance, overlap each other, or reach their latitudinal or longitudinal limits of natural distribution; thus with the beech, sugar maple, the various oaks and other trees of the north, grow the bald cypress, the tupelo gum and the water locust of the south, and the catalpa and pecan of the southwest; while other trees such as the buckeyes, honey locust, black locust, coffee-bean, etc., especially characteristic of the country west of the Alleghanies, reach here their maximum of abundance. At the same time other trees of more extended distribution, grow scarcely anywhere else to such majestic size as they do here in the rich alluvial bottoms, the deep soil of which nourishes black walnuts, tulip trees, sycamores, white ashes and sweet gums of astonishing dimensions.

The mixed woods of the lower Wabash Valley consist of upwards of ninety species of trees, including all of those which reach a maximum height of over twenty feet; these are distributed through about twenty-five orders and fifty genera. In the heavy forests of the rich bottom lands more than sixty species usually grow together, though in various localities different species are the predominating ones.

The trees which usually attain the largest size are the following species, named nearly in the order of their maximum size:—sycamore (*Platanus occidentalis*), tulip-poplar (*Liriodendron tulipifera*), pecan (*Carya oliveæformis*), over-cup or bur-oak (*Quercus*

macrocarpa), "Spanish oak" (*Q. coccinea* var?), white ash (*Fraxinus Americana*), bald cypress (*Taxodium distichum*), sweet gum (*Liquidambar styraciflua*), black walnut (*Juglans nigra*), white elm (*Ulmus Americana*), honey locust (*Gleditschia triacanthos*), cottonwood (*Populus monilifera*), beech (*Fagus ferruginea*), shell-bark hickory (*Carya alba?*), and white oak (*Quercus alba*). All of these often exceed one hundred and fifty feet in height, while the first three are known to go beyond one hundred and seventy-five feet, and no doubt sometimes nearly approach, if they do not actually reach, the altitude of two hundred feet. The principal trees of the second magnitude (*i. e.* which do not often grow more than one hundred feet high, and are more usually seventy feet and upwards), are hickories (*Carya sulcata*, *C. amara*, *C. tomentosa* and *C. porcina*), red oak (*Quercus rubra*), water oak or pin oak (*Q. palustris*), swamp white oak (*Q. bicolor*), swamp chestnut oak (*Q. prinos*), linden or bass-wood (*Tilia Americana*), sweet buckeye (*Æsculus flava*), sugar maple (*Acer saccharinum*), red maple (*A. rubrum*), silver maple (*A. dasycarpum*), black locust (*Robinia pseudacacia*), coffee-bean (*Gymnocladus Canadensis*), water locust (*Gleditschia monosperma*), black cherry (*Prunus serotina*), sour and tupelo gum (*Nyssa multiflora* and *N. uniflora*), blue ash (*Fraxinus quadrangulata*), black ash (*Fraxinus sambucifolia*), hackberries (*Celtis occidentalis* and *C. Mississippiensis*), black and yellow birches (*Betula nigra* and *B. lenta*), etc. Some of these trees, as the oaks and hickories, occasionally attain a very large size, equalling those of the first magnitude; but as a general thing, they do not grow much, if any, beyond one hundred feet in height.

The more abundant or characteristic of the middle-sized trees, or those usually growing from forty to seventy feet in height, are the following:—box elder (*Negundo aceroides*), fœtid buckeye (*Æsculus glabra*), persimmon (*Diospyros Virginicus*), catalpa (*Catalpa bignonioides*), red ash (*Fraxinus pubescens*), sassafras (*Sassafras officinale*), red or slippery elm (*Ulmus fulva*), winged elm (*U. alata*), mulberry (*Morus rubra*), butternut, or white walnut (*Juglans cinerea*), post oak (*Quercus obtusiloba*—not frequent in the bottom-lands), willow oak (*Q. phellos*—rare), and laurel oak (*Quercus imbricaria*). The underwoods, composed of small trees from twenty to forty feet in height, are chiefly of the following species: pawpaw (*Asimina triloba*), prickly ash (*Xanthoxylum America-*

num), hop tree (*Ptelea trifoliata*), stag-horn, smooth and poison sumacs (*Rhus typhina*, *R. glabra* and *R. venenata*), redbud (*Cercis Canadensis*), wild plums and choke cherries (*Prunus Americana*, *P. Pensylvanica* and *P. Virginiana*), hawthorns, or "red haws" (*Crataegus coccinea*, *C. tomentosa*, *C. crus-galli*, and *C. flava*), crab apple (*Pyrus coronaria*), June berry (*Amelanchier Canadensis*,) witch hazel (*Hamamelis Virginica*), dogwoods (*Cornus florida* and *C. alternifolia*), Viburnum (*Viburnum lentago*), black haw (*V. prunifolium*), green ash (*Fraxinus viridis*), iron-wood, or hop hornbeam (*Ostrya Virginica*), hornbeam, or water beech (*Carpinus Americanus*), etc.

The shrubby undergrowth or "underbush" is extremely varied and often so dense as to be nearly, if not quite, impenetrable. In the bottom lands it is composed in the main of spice bush (*Lindera benzoin* and *L. melissæfolia?*) and buttonbush (*Cephalanthus occidentalis*), which are the predominating species, the former generally distributed, and the latter mainly confined to the banks and ends of lagoons; but both are mingled with other shrubs far too numerous in species to mention, or nearly replaced by dense brakes of the small cane (*Arundinaria tecta*), and rank herbaceous plants, in almost endless variety.

In the heavy forests of the bottom-lands, which in many places have entirely escaped the ravages of the axe, the magnitude of the timber is such as is unknown to the scant woods of the eastern states, the stiff monotonous pineries of the north or the scrubby growth of other portions. The river flows for the greater part between dense walls of forest, which stand up to the very banks, and generally screened in front with a dense fringe of willows, with a belt of cottonwood and sycamores behind it. Viewing this forest wall from the opposite side of the river, there is seen a compact mass of verdure, the trunks of the trees being often hidden by the fronting belt of willows, which are often overrun by luxuriant masses of wild grape or other vines, often falling down to the very water's edge, so that even the bank itself is wholly concealed. If the forest is viewed from a high bluff, it presents the appearance of a compact, level sea of green, apparently almost endless, but bounded by the line of wooded bluffs three to seven miles back from the river; the tree-tops swaying with the passing breeze, and the general level broken by occasional giant trees which rear their massive heads so as to overlook the surrounding miles of

forest. The approximate height above the ground beneath of the average tree-top level is about one hundred and thirty feet—the lowest estimate after a series of careful measurements—while the occasional, and by no means infrequent, "monarchs" which often tower apparently for one-third their height above the tree-top line, attain an altitude of more than one hundred and eighty feet, or approach two hundred feet.

Of the ninety to a hundred species of trees of the lower Wabash Valley, about seventy exceed the height of forty feet; forty-six (perhaps fifty) exceed seventy feet in height, and about thirty are known to reach or exceed the height of one hundred feet. Of the latter class, as many as nine are known certainly to reach, or even exceed, the altitude of one hundred and fifty feet, while four of them (sycamore, tulip-poplar, pecan and sweet gum), attain, or go beyond, an elevation of one hundred and seventy-five feet! The maximum elevation of the tallest sycamore and tulip trees is probably not less than two hundred feet.

Going into these primitive woods, we find symmetrical, solid trunks of six feet and upwards in diameter, and fifty feet, or more, long to be not uncommon, in half a dozen or more species; while now and then we happen on one of those old sycamores, for which the rich alluvial bottoms of the western rivers are so famous, with a trunk thirty or even forty, possibly fifty or sixty, feet in circumference, while perhaps a hundred feet overhead stretch out its great white arms, each as large as the biggest trunks themselves of most eastern forests, and whose massive head is one of those which lifts itself so high above the surrounding tree-tops. The tall, shaft-like trunks of pecans, sweet gums or ashes, occasionally break on the sight through the dense undergrowth, or stand clear and upright in unobstructed view in the rich wet woods, and rise straight as an arrow for eighty or ninety, perhaps over a hundred, feet before the first branches are thrown out.

The following summaries of measurements, made in the summer and fall of 1871, in the vicinity of Mt. Carmel, Illinois, and mostly within a radius of ten miles, will serve to show pretty well the usual size of the large timber in that neighborhood. The measurements in the first column do not by any means represent the real maximum height of these species of trees in the Wabash Valley, since it was not often that trees of the largest size were found prostrate so that the total height and length of the trunk

could be measured satisfactorily. Very many trees seen and for these reasons not measured would materially swell the figures in the first two columns.

TABLE OF MAXIMUM SIZE ACCORDING TO TAPE LINE MEASUREMENTS.

	Total Height.	Length of trunk to first branch.	Circumference at 3 to 5 feet from ground.
Sycamore (*Platanus occidentalis*).*	168	68	33½
Tulip Poplar (*Liriodendron tulipifera*) †	182	91	23½
Pecan (*Carya olivæformis*)	175	90	16
White Ash (*Fraxinus Americana*)	144	90	17½
Black Walnut (*Juglans nigra*)	120	60	22
"Spanish Oak" (*Quercus tinctoria?*)	150	75	20
Bur Oak (*Quercus macrocarpa*)	162	70	21
White Oak (*Quercus alba*)	142	60	17½
Cottonwood (*Populus monilifera*) ‡	165	75	19
Honey Locust (*Gleditschia triacanthos*)	120	50	17
Sweet Gum (*Liquidambar styraciflua*) §	144	70	17
Red Maple (*Acer rubrum*)	108	70	11½
Bass (*Tilia Americana*)			17
Sassafras (*Sassafras officinale*)	95!	75!	7½
Mulberry (*Morus rubra*)	60	20	10

TABLE OF AVERAGE DIMENSIONS.

SYCAMORE (*Platanus occidentalis*).

Height	168	feet.	(Only one tree measured).
Trunk	18	"	
Circ.	28	"	Mean of 9 trees.

This is certainly the largest, both in height and bulk, of all the trees of the Mississippi Valley. Its form is very variable, the

*Only one tree measured for height, and this by no means a large one. I have been told on the very best authority of trunks forty feet in circumference.

† I know of one, not measured by myself, thirty-two feet in circumference, and have been told of a stump in Posey County, Indiana, which around the top is thirty-seven feet in circumference.

‡ The tallest cottonwoods are no doubt one hundred and eighty feet or more in height.

§ The tallest sweet gums are certainly 160-180 feet, perhaps much more in height, and with clear shafts of over a hundred feet in length.

trunk being sometimes a tall arrow-like shaft, equalling the finest *Coniferæ* in straightness and gradual taper, the first branches being ninety to a hundred feet above the ground; but oftener, on the other hand, it is short and bulky, ten, fifteen or even rarely twenty feet in diameter, and only fifteen or twenty feet high, where three or four gigantic trunks separate and rise into a lofty massive head. The tallest of these sycamores rise apparently for one-third their height above the tree-top level of the forest, and are thus probably not less than two hundred feet in height.

TULIP TREE (*Liriodendron tulipifera*).

Height	$142\frac{7}{19}$	feet.	Mean of	19	trees.
Trunk	$69\frac{4}{5}$	"	" "	20	"
Circ.	$19\frac{1}{3}$	"	" "	24	"

The second tree in size and very commonly of the above dimensions. The finest individual found prostrate was one cut for lumber near Timberville, Wabash County, Illinois; it measured one hundred and fifty-eight feet in total length, while the trunk was twenty-three feet in circumference three feet from the base, and eighteen feet in circumference at seventy-four feet further up, where the first branch grew; *the trunk perfectly sound and symmetrical throughout.*

PECAN (*Carya olivæformis*).

Height	170	feet.	Mean of	3	trees.
Trunk	85	"	" "	3	"
Circ.	$15\frac{2}{3}$	"	" "	3	"

One of the most symmetrical and majestic of all our trees; the trunk clean, straight and long, and the head spreading and slightly drooping, usually elevated sixty to ninety feet from the ground.

WHITE ASH (*Fraxinus Americana*).

Height	$140\frac{1}{2}$	feet.	Mean of	2	trees.
Trunk	$79\frac{1}{2}$	"	" "	3	"
Circ.	14	"	" "	5	"

Also one of our finest trees; the trunk long and slightly tapering, though generally less straight than that of the pecan and "Spanish oak," and with the top less spreading.

num), hop tree (*Ptelea trifoliata*), stag-horn, smooth and poison sumacs (*Rhus typhina*, *R. glabra* and *R. venenata*), redbud (*Cercis Canadensis*), wild plums and choke cherries (*Prunus Americana*, *P. Pensylvanica* and *P. Virginiana*), hawthorns, or "red haws" (*Crataegus coccinea*, *C. tomentosa*, *C. crus-galli*, and *C. flava*), crab apple (*Pyrus coronaria*), June berry (*Amelanchier Canadensis*,) witch hazel (*Hamamelis Virginica*), dogwoods (*Cornus florida* and *C. alternifolia*), Viburnum (*Viburnum lentago*), black haw (*V. prunifolium*), green ash (*Fraxinus viridis*), iron-wood, or hop hornbeam (*Ostrya Virginica*), hornbeam, or water beech (*Carpinus Americanus*), etc.

The shrubby undergrowth or "underbush" is extremely varied and often so dense as to be nearly, if not quite, impenetrable. In the bottom lands it is composed in the main of spice bush (*Lindera benzoin* and *L. melissæfolia?*) and buttonbush (*Cephalanthus occidentalis*), which are the predominating species, the former generally distributed, and the latter mainly confined to the banks and ends of lagoons; but both are mingled with other shrubs far too numerous in species to mention, or nearly replaced by dense brakes of the small cane (*Arundinaria tecta*), and rank herbaceous plants, in almost endless variety.

In the heavy forests of the bottom-lands, which in many places have entirely escaped the ravages of the axe, the magnitude of the timber is such as is unknown to the scant woods of the eastern states, the stiff monotonous pineries of the north or the scrubby growth of other portions. The river flows for the greater part between dense walls of forest, which stand up to the very banks, and generally screened in front with a dense fringe of willows, with a belt of cottonwood and sycamores behind it. Viewing this forest wall from the opposite side of the river, there is seen a compact mass of verdure, the trunks of the trees being often hidden by the fronting belt of willows, which are often overrun by luxuriant masses of wild grape or other vines, often falling down to the very water's edge, so that even the bank itself is wholly concealed. If the forest is viewed from a high bluff, it presents the appearance of a compact, level sea of green, apparently almost endless, but bounded by the line of wooded bluffs three to seven miles back from the river; the tree-tops swaying with the passing breeze, and the general level broken by occasional giant trees which rear their massive heads so as to overlook the surrounding miles of

forest. The approximate height above the ground beneath of the average tree-top level is about one hundred and thirty feet—the lowest estimate after a series of careful measurements—while the occasional, and by no means infrequent, "monarchs" which often tower apparently for one-third their height above the tree-top line, attain an altitude of more than one hundred and eighty feet, or approach two hundred feet.

Of the ninety to a hundred species of trees of the lower Wabash Valley, about seventy exceed the height of forty feet; forty-six (perhaps fifty) exceed seventy feet in height, and about thirty are known to reach or exceed the height of one hundred feet. Of the latter class, as many as nine are known certainly to reach, or even exceed, the altitude of one hundred and fifty feet, while four of them (sycamore, tulip-poplar, pecan and sweet gum), attain, or go beyond, an elevation of one hundred and seventy-five feet! The maximum elevation of the tallest sycamore and tulip trees is probably not less than two hundred feet.

Going into these primitive woods, we find symmetrical, solid trunks of six feet and upwards in diameter, and fifty feet, or more, long to be not uncommon, in half a dozen or more species; while now and then we happen on one of those old sycamores, for which the rich alluvial bottoms of the western rivers are so famous, with a trunk thirty or even forty, possibly fifty or sixty, feet in circumference, while perhaps a hundred feet overhead stretch out its great white arms, each as large as the biggest trunks themselves of most eastern forests, and whose massive head is one of those which lifts itself so high above the surrounding tree-tops. The tall, shaft-like trunks of pecans, sweet gums or ashes, occasionally break on the sight through the dense undergrowth, or stand clear and upright in unobstructed view in the rich wet woods, and rise straight as an arrow for eighty or ninety, perhaps over a hundred, feet before the first branches are thrown out.

The following summaries of measurements, made in the summer and fall of 1871, in the vicinity of Mt. Carmel, Illinois, and mostly within a radius of ten miles, will serve to show pretty well the usual size of the large timber in that neighborhood. The measurements in the first column do not by any means represent the real maximum height of these species of trees in the Wabash Valley, since it was not often that trees of the largest size were found prostrate so that the total height and length of the trunk

could be measured satisfactorily. Very many trees seen and for these reasons not measured would materially swell the figures in the first two columns.

TABLE OF MAXIMUM SIZE ACCORDING TO TAPE LINE MEASUREMENTS.

	Total Height.	Length of trunk to first branch.	Circumference at 3 to 5 feet from ground.
Sycamore (*Platanus occidentalis*).*	168	68	33½
Tulip Poplar (*Liriodendron tulipifera*) †	182	91	23½
Pecan (*Carya olivæformis*)	175	90	16
White Ash (*Fraxinus Americana*)	144	90	17½
Black Walnut (*Juglans nigra*)	120	60	22
"Spanish Oak" (*Quercus tinctoria*?)	150	75	20
Bur Oak (*Quercus macrocarpa*)	162	70	21
White Oak (*Quercus alba*)	142	60	17½
Cottonwood (*Populus monilifera*) ‡	165	75	19
Honey Locust (*Gleditschia triacanthos*)	120	50	17
Sweet Gum (*Liquidambar styraciflua*) §	144	70	17
Red Maple (*Acer rubrum*)	108	70	11½
Bass (*Tilia Americana*)			17
Sassafras (*Sassafras officinale*)	95!	75!	7½
Mulberry (*Morus rubra*)	60	20	10

TABLE OF AVERAGE DIMENSIONS.

SYCAMORE (*Platanus occidentalis*).

Height	168	feet.	(Only one tree measured).
Trunk	18	"	
Circ.	28	"	Mean of 9 trees.

This is certainly the largest, both in height and bulk, of all the trees of the Mississippi Valley. Its form is very variable, the

*Only one tree measured for height, and this by no means a large one. I have been told on the very best authority of trunks forty feet in circumference.

† I know of one, not measured by myself, thirty-two feet in circumference, and have been told of a stump in Posey County, Indiana, which around the top is thirty-seven feet in circumference.

‡ The tallest cottonwoods are no doubt one hundred and eighty feet or more in height.

§ The tallest sweet gums are certainly 160-180 feet, perhaps much more in height, and with clear shafts of over a hundred feet in length.

trunk being sometimes a tall arrow-like shaft, equalling the finest *Coniferæ* in straightness and gradual taper, the first branches being ninety to a hundred feet above the ground; but oftener, on the other hand, it is short and bulky, ten, fifteen or even rarely twenty feet in diameter, and only fifteen or twenty feet high, where three or four gigantic trunks separate and rise into a lofty massive head. The tallest of these sycamores rise apparently for one-third their height above the tree-top level of the forest, and are thus probably not less than two hundred feet in height.

TULIP TREE (*Liriodendron tulipifera*).

Height	$142\frac{7}{15}$	feet.	Mean of	19	trees.
Trunk	$69\frac{4}{5}$	"	"	"	20	"
Circ.	$19\frac{1}{3}$	"	"	"	24	"

The second tree in size and very commonly of the above dimensions. The finest individual found prostrate was one cut for lumber near Timberville, Wabash County, Illinois; it measured one hundred and fifty-eight feet in total length, while the trunk was twenty-three feet in circumference three feet from the base, and eighteen feet in circumference at seventy-four feet further up, where the first branch grew; *the trunk perfectly sound and symmetrical throughout.*

PECAN (*Carya olivæformis*).

Height	170	feet.	Mean of	3	trees.
Trunk	85	"	"	"	3	"
Circ.	$15\frac{2}{3}$	"	"	"	3	"

One of the most symmetrical and majestic of all our trees; the trunk clean, straight and long, and the head spreading and slightly drooping, usually elevated sixty to ninety feet from the ground.

WHITE ASH (*Fraxinus Americana*).

Height	$140\frac{1}{2}$	feet.	Mean of	2	trees.
Trunk	$79\frac{1}{2}$	"	"	"	3	"
Circ.	14	"	"	"	5	"

Also one of our finest trees; the trunk long and slightly tapering, though generally less straight than that of the pecan and "Spanish oak," and with the top less spreading.

BLACK WALNUT (*Juglans nigra*).

Height	125	feet.	Mean of 2 trees.
Trunk	50	"	" " " "
Circ.	$18\frac{1}{3}$	"	" " 3 "

Trunks of fifteen feet in circumference and forty or fifty feet long very common, so much so that in one locality in the "bottoms" five trees of this size stood within sight all at the same time in the thick woods.

"SPANISH OAK" (*Quercus coccinea* var?).

Height	$120\frac{2}{3}$	feet.	Mean of 6 trees.
Trunk	$58\frac{4}{5}$	"	" " 5 "
Circ.	$17\frac{1}{2}$	"	" " 6 "

The most stately and symmetrical of all our oaks; trunk straight and columnar and top massive and dense, reminding one in its appearance of the pecan. A more usual size is one hundred and fifty feet high, the trunk fifty feet long and fifteen feet in circumference four feet from the base.

BUR OAK (*Quercus macrocarpa*).

Height	$119\frac{1}{5}$	feet.	Mean of 5 trees.
Trunk	$42\frac{2}{5}$	"	" " " "
Circ.	19	"	" " 6 "

The most massive, in proportion to its height, of all our oaks.

WHITE OAK (*Quercus alba*).

Height	$115\frac{1}{6}$	feet.	Mean of 6 trees.
Trunk	$48\frac{1}{3}$	"	" " 6 "
Circ.	$14\frac{3}{4}$	"	" " 8 "

COTTONWOOD (*Populus monilifera*).

Height	$142\frac{1}{2}$	feet.	Mean of 4 trees.
Trunk	$61\frac{2}{3}$	"	" " 3 "
Circ.	$15\frac{1}{3}$	"	" " 6 "

SWEET GUM (*Liquidambar styraciflua*).

Height	$117\frac{3}{7}$	feet.	Mean of 7 trees.
Trunk	$62\frac{1}{2}$	"	" " 4 "
Circ.	$11\frac{7}{8}$	"	" " 8 "

The tallest tree in proportion to its girth. The largest shafts are probably over one hundred feet, and the greatest circumference about seventeen or eighteen feet; while many trees no doubt exceed one hundred and sixty feet in height.

SASSAFRAS (*Sassafras officinale*).

Height	$71\frac{2}{3}$	feet.	Mean of	3	trees.	
Trunk	$52\frac{1}{2}$	"	"	"	2	"
Circ.	$7\frac{2}{3}$	"	"	"	3	"

Though usually considered one of the "underwoods," this tree is not unfrequently of these dimensions in very rich woods.

FOSSIL INSECTS FROM THE ROCKY MOUNTAINS.

BY SAMUEL H. SCUDDER.

SEVERAL years ago, Professor William Denton discovered in shales lying near the junction of the Green and White Rivers in Colorado (?), the first traces of tertiary insects on this continent. They were found in two distinct localities, sixty miles apart, the specimens from one place differing from those of the other, not only specifically, but also to a very great extent in the general character of the whole assemblage.* Reports of these discoveries attracted the attention of those who afterward explored parts of the Rocky Mountain region, and repeated inquiries were made concerning the exact location of the insectiferous beds. These explorations have resulted in the discovery of more fossil insects in the same general region by Mr. F. C. A. Richardson, who accompanied Major Powell's exploring party, and by Dr. Hayden in some of his numerous and fruitful researches. The latter brought home only three specimens, two flies and an ant, but the collections of the former are more numerous and afford material for the present notice.

Some doubt exists as to whether the insects discovered by Prof.

* See Proc. Bost. Soc. Nat. Hist., xi, 117-118. A detailed and illustrated Report upon these fossils, which Mr. Denton kindly lent for a long period of examination, will shortly be published.

Denton were found in Colorado (as stated) or Wyoming Territory. Those now under consideration purport to come from the latter district,* as stated in the subjoined letter to the editors, though far removed from the vicinity of Chagrin Valley or Fossil Cañon, the two localities explored by Professor Denton. About one hundred slabs, mostly of very small size, were brought away; these contain at least one hundred and seventy-five specimens, including in that number all the reverses. Of these specimens thirty-five cannot be referred with certainty to any subordinal group, since they consist merely of abdominal segments or blurred and distorted fragments, the affinities of which can only be rudely surmised. The remainder are referable to nearly forty species, belonging to the following groups, mainly arranged in the order of numerical superiority:

Diptera,	thirteen	species,	sixty-six	specimens.
Coleoptera,	twelve	"	fifty-two	"
Hymenoptera,	three	"	five	"
Hemiptera,	two	"	four	"
Orthoptera,	two	"	four	"
Neuroptera,	two	"	two	"
Arachnida.	three	"	six	"
Myriapoda,	one	"	one	"

Of the Diptera, one-half the specimens belong to a single or possibly two heavy-bodied species of small size, which, although invariably wingless, are presumed to be so only by mutilation, since exceedingly few wings are preserved on any of the stones; of the other half, two-thirds are *Tipulidæ* or *Mycetophilidæ*

* "I discovered and collected the fossil insects on the Green River in Wyoming Territory on the line of the Union Pacific Railroad about forty miles this side (east) of Salt Lake City. Or, to be more precise, the locality is five miles west of Green River City and on the railroad track. The latitude and longitude as near as I can make out from very imperfect memoranda are as follows, *Latitude* 41° 40′ north, *Longitude* 109° 50′ west. I had a short time previous found two very imperfect fossil insects but could find no strata nor spot where any number could be obtained. I was then with the courteous explorer, Major Powell, and left the fossils with him. I returned a short time after (on account of poor health), and, while looking for fossil fish and leaves, found a stratum some two or three inches thick exposed in a railroad cut from ten to twenty feet from the top rock or sandstone; the rock, as near as my memory will serve me, dips to the southwest at quite an angle. The shale or portion of the shale on which the insects are found runs in a circle from the northeast to the southwest, as if on the border of a small lake. I also noticed that the fish are not in a regular order as the insects, which cover a space about two feet wide and form a ring or belt around the lake as near as I could make out from the appearance. The fossil insects, fishes, leaves and fruit abound in that section but are being rapidly worked up, thanks to the diligence of our naturalists and the kindness of the Superintendent, Gen. Sickles of the Union Pacific Railroad, to whom I am greatly indebted."—F. C. A. RICHARDSON, *Pres. Chicago Natural History Society*, *Aug.* 5, 1872.

and include five of the species, while the remaining sixth comprises about half the species and belongs to various groups. Of the Coleoptera, fully one-half the species and about seven-tenths of the specimens belong to the *Curculionidæ;* the others mostly to the *Staphylinidæ* and *Carabidæ*. These two suborders, flies and beetles, comprise the bulk of the determinable objects — nearly six-sevenths of the specimens and more than five-eighths of the species. The Hymenoptera consist of a small ant, a Pteromalus-like insect, and one rather obscure form. The Hemiptera are represented by an insect resembling Issus and another apparently belonging to the *Tingidæ*. In the Orthoptera there are only legs of a Locustarian about as large as our common Phylloptera and a cricket, perhaps of the genus Nemobius. Two Phryganeids are represented by wings, one of them doubtfully located in this family. Of the gally worm and spiders little can be said.

The interest in these objects is greatly increased when they are compared with the others brought from the same region. In the first place, the shales from "Chagrin valley" and "Fossil Cañon," are dark gray in tint, while those containing the insects now under discussion are of a reddish clay-color; the former are much more closely grained and of a firmer texture, resembling lithographic stone, and the objects are consequently better preserved — indeed on some slabs the hairs along the edge of a wing in a Thrips may be counted.

Again, the faunæ of the several localities differ. We have already remarked in a previous paper that this is the case with the specimens from Chagrin Valley and Fossil Cañon, although the stones themselves are similar in character. *Mycetophilidæ* and other Diptera are found in both places, "but in Fossil Cañon, the variety and abundance are proportionately greater; the ants, the moths, the Thrips and nearly all the smaller Coleoptera are restricted to Fossil Cañon, while the larvæ come from Chagrin Valley." The same is true of Mr. Richardson's specimens; not a single species can be definitely referred to any of those found by Prof. Denton, and the assemblage of species is different: thus, a single fragment of an elytron is the only Curculionid in the Chagrin Valley shales, and probably it is generically distinct from all those mentioned above. The type of fly spoken of as so abundant in the shales collected by Mr. Richardson is represented in the previous collection only by a single specimen from Fossil Cañon,

probably belonging to a different genus. The two forms mentioned under the name of Issus, one from Richardson's shales and the other from Chagrin Valley, are not congeneric; and the same is probably true of the ants from these shales and from Fossil Cañon. It is in the *Mycetophilidæ* and *Tipulidæ*, however, that we find the closest resemblance between the different collections; in the comparative abundance and variety of these insects, the shales worked by Mr. Richardson may best be compared to those of Fossil Cañon, but in the former the specimens are too poorly preserved to make a close identification very satisfactory; the genus Dicranomyia is apparently found in all three localities. Comparing the assemblages of species, we find that Diptera and Coleoptera are the prevailing forms in each,* but that within these groups the types differ in a remarkable manner, according to their several localities; the Orthoptera and Neuroptera, the spiders and Myriapoda of the later discovered beds are wholly wanting in the earlier; the Lepidoptera and Physopoda are found only in Fossil Cañon, and no trace of ants appears in Chagrin Valley, though occurring in the other two places and also in the locality examined by Dr. Hayden.

These results should not surprise us, since in the two rich quarries of Œningen, Baden, one of which is only a mile distant from, and about one hundred and fifty feet above the other, the insects are found to be specifically distinct throughout. Probably some of these conclusions will be modified by a more searching study of the remains under examination; unquestionably they will be altered by further researches in the field; and certainly these tertiary beds of the Rocky Mountains appear exceedingly rich in insect remains, and are worth careful exploration; that they extend over several successive geological stages seems probable from the great diversity of character in these fragmentary collections, and also from Prof. Denton's statement that the shales in which they occur have a thickness of a thousand feet.

*All the insects as a rule are rather small in size.

THE GEOLOGICAL AGE OF THE COAL OF WYOMING.

BY EDWARD D. COPE, A.M.*

In his Geological Survey of Wyoming, Professor F. V. Hayden thus describes the great coal area of Wyoming. "About two miles west of Rawling's, springs begin to appear again, and at Separation *Platanus Haydenii*, *Cornus acuminata* and other undetermined species of plants occur. This point forms the eastern rim of a basin which extends about one hundred and ten miles to the westward. A new group comes in which I have named the Washakie group, from the fact that near this station are beds of calcareous sandstone and limestone, composed of an aggregate of fresh water shells. As they are mostly casts it is difficult to identify the species, but Mr. Meek has named the most abundant kind, *Unio Vasakei*. Soon after leaving Bitter Creek, coal strata of Eocene age rise to the surface from beneath the surface of the Miocene beds of the Washakie group, with a reversed dip. Here we find numerous beds of coal, and in the rocks above and below the coal, are great numbers of impressions of leaves, and in the clay, oyster shells of several species. At Black Buttes Station eight hundred and fifty miles west of Omaha, we find *Sabal Campbellii*, *Rhamnus elegans*, etc. At Point of Rocks farther west, *Platanus Haydenii*, *Cornus acuminata*, etc., occur. At Hallville the black slaty clays forming the roof of one of the most valuable of the coal beds of this region, are crowded with bivalve shells, two species of which Mr. Meek has named *Cyrena fracta* and *C. crassatelliformis*, regarding them as Tertiary. They are undoubtedly brackish water forms, and show a sort of middle position, that is middle or upper Eocene. That there is a connection between all the coal beds of the west I am prepared to believe, yet until much clearer light is thrown upon their origin than any we have yet secured, I shall regard them as belonging to any transition series or beds of passage between the true Cretaceous and the Tertiary. It will be seen at once that one of the most important problems in the geology of the West awaits solution, in detecting without a doubt the

* Read at the Dubuque Meeting of the American Association for the Advancement of Science. Aug., 1872.

age of the coal series of the west, and the exact line of demarcation between the Cretaceous and Tertiary periods." (Report 1870 pp. 164–5.) Thus Prof. Hayden left the subject at that time.

In passing over the region from Ft. Bridger to Black Buttes during the present season, I traversed successively the strata of the Bridger and Green River epochs. Near Rock Spring Station the coal group makes its appearance, rising from beneath the Green River strata, as it appeared to me without instrumental aid with some degree of uncomformability. This forms the western border of an upthrust of rocks of which Dr. Hayden has treated in the above extract. At Rock Spring eleven coal beds have been struck in shafting, of which the upper and thickest is ten feet in depth. The rocks are buff sandstone nearly worn, alternating with gray sandstones and shales. They descend again near Point of Rocks and remain nearly level at Black Buttes. At Hallville I obtained isolated scales of numerous species of fishes. At Black Buttes I learned that Mr. F. B. Meek had visited the neighborhood, and had discovered the bones of some large animal. I went to the spot and found fragments of large bones lying in a bed of fossil leaves. On excavating, other bones were obtained including sixteen vertebræ, the sacrum, both ilia and other pelvic bones, with ribs and bones of the limbs. The position of the bones was in a bed of gray sandstone, above one coal bed and below two. They were covered with the leaves which had evidently fallen upon them, and filled the intervals between them, and occupied the angles between the processes, the neural canal, etc., just as they had been pressed in when soft. The skeleton had fallen on the shore, for the leaf bed passed gradually into a shell bed, which included mostly thin bivalved species.

The pelvic and sacral bones, in fact every part of the skeleton proved the reptile to have been a Dinosaurian. The entire dorsal vertebra was twenty-eight inches in height and the ilium between three and four feet in length; both extremities are straight, the one massive, the other dilated and thin, with a superior process. It resembles that of Cetiosaurus more than any other but presents well defined differences. It is named *Agathaumas sylvestris.*

This discovery places this group without doubt within the limits of the Cretaceous period, and to that age we must now refer the great coal area of Wyoming. It is surrounded to the west and

south and perhaps to the north by Eocene Tertiary beds, and the appearance of the country indicates that a smaller lapse of time has separated the periods of their deposit than is usual. Nevertheless no traces of Cretaceous types of vertebrates have yet been found in any of these Tertiaries.

EFFECTS OF EXTRAORDINARY SEASONS ON THE DISTRIBUTION OF ANIMALS AND PLANTS.

BY PROF. N. S. SHALER.

WHATEVER throws any light upon the nature of the means whereby the changes in the character and distribution of organic forms have been effected, has for the student of geology the keenest interest. I therefore venture to call attention to the peculiar effects of the last year upon the forests and probably upon some of the animals of New England. The year preceding the winter of 1871–2 was one of the dryest on record in this region; the rainfall was not only much less than usual, but came in such a fashion as to leave the ground very dry when winter came. The snowfall during the winter was slight and did not lie well upon the ground, melting and drifting in such fashion as to leave a large part of the surface quite unprotected. In this state the long continued and steady cold froze the earth to a great depth, and at some points the frozen ground was found as far as five feet from the surface. Over the whole of New England it was doubtless deep enough to involve the whole of the roots of the vegetation of our forests. It is doubtful whether it was the intensity of the cold alone which produced the effects which have been observed all about us, but more likely that it was in large part due to the deficiency of sap in the plants, in connection with the low temperature; as the frost left the roots, they remained for some time in contact with relatively dry earth, thus causing a shock too great for their vitality to withstand. I do not see clearly just how the cold and drought coöperated in bringing about this destruction, though I have no doubt they worked together.

The tree which suffered most is the arbor-vitæ (*Thuja occidentalis*) for more than half of these are dead and a large part of those

yet alive are in a critical condition. The red cedar (*Juniperus Virginiana*) is also a great sufferer in some regions, most of the specimens being dead or dying, while in others the greater part are unhurt. The yellow and white pines (*P. mitis* and *P. strobus*) are also much injured in many places, though in most cases immediate death has not resulted. All the other coniferous trees about Massachusetts Bay have suffered more or less. The greatest amount of damage seems to have taken place in sandy soils. So far as I have been able to observe, the trees placed so as to receive the greatest amount of moisture have on the whole withstood the crisis the best. The deciduous trees appear to have come out without damage; I have not yet been able to find any evidence of unusual loss among them. The same may be said for our herbaceous plants which, so far as my limited knowledge goes, show no signs of damage.

The only change in animal life which I have noticed is the comparative scarcity of snakes. In about two hundred miles of walking in the fields and woods I have encountered but three; of course, in a matter where it is so difficult to be sure of comparative numbers in different seasons, it will not do to make positive assertions, but I am strongly inclined to believe that the same amount of walking would have shown me several times as many snakes in former years. I am sure that this is the first year that I have gone until July spending at least one day in the week in the open air, without seeing a black snake. Toads seem to me also much less common than usual.

The most interesting point in this connection is the question as to what would have been the effect of carrying this accident of climate a little further. Small as the destruction of forest trees is, it will doubtless add several per cent. to the deciduous trees of New England, and remove an equal amount of conifers. The conifers seem to be relics of an old time and not competent to wage a successful war with their younger and more elastic competitors, the oaks, beeches and other deciduous trees. Every gap that is made in our forests of cone-bearing species is filled not with their legitimate successors, but by forms from the other class of trees. Let us suppose that the shock of the last season had been great enough to kill off the whole of our pines, the result would have been a complete change in the character of our forests; oaks generally would take the vacant place. This would

affect the character of the undergrowth very materially, for the lesser plants of a pine wood are very different from those which flourish beneath oaks. This would have had a very great effect upon insect life, and more or less directly influenced the number and character of the birds and the mammals. Even the climate would be in some small measure influenced, for a pine forest retains the snow better than one which loses its leaves in the winter and thus tends to secure a more equable temperature in the region where it lies.

Thus we see that an accidental drought might bring about a change in the assemblage of vital conditions on the surface of the land, as great as those which, when recorded in strata, we accept as indicating distinct geological formations.

It may not be amiss in passing, to call attention to the fact that the rate of change in land life, as far as change depends upon variations of temperature, must be far greater than in the sea. The sea knows no such frequent accidents of heat, cold and moisture as are at work on the land.* The difference in these conditions is well measured by the range of migration of species. Our Liquidambars, Liriodendrons, and other forest trees of the Mississippi Valley have, during the later stages of the Tertiary period, ranged as far as Greenland, or through over forty degrees of latitude. The greatest range of marine forms, as far as I am aware, is not more than one-third this amount in the same limits of time.

It is very desirable that abundant observations on the influence of the last winter on animal and vegetable life should be put on record. The author of these remarks would be glad to hear communications on this subject. Any information of importance will be printed in this journal with the proper acknowledgments.

* In one way marine accidents may produce great changes of temperature in the sea. This is readily conceived by the following example. The destruction of Cape Cod would lower the average summer temperature of the region about Vineyard Sound by twenty degrees or so. The result would be the expulsion from that region of at least one-fifth of the marine forms now found there.

REVIEWS AND BOOK NOTICES.

CORALS AND CORAL ISLANDS.*—This delightful book is not the work simply of a zoologist, or a physical geologist or geographer, but of one who combines to a remarkable degree the qualities of each. The book will interest and instruct not only the student in each of those departments of science, but so simple and yet so comprehensive is the author's presentation of an intricate subject that it will be pleasant reading to any one.

The names of Darwin and Dana will always be associated with the study of coral reefs, and it is pleasant to learn of the ingenuous and enthusiastic admiration with which the American speaks in the following passage of the earlier labors of the English naturalist:

"Our cruise led us partly along the course followed by Mr. Charles Darwin during the years 1831 to 1836, in the voyage of the Beagle, under Captain Fitzroy; and, where it diverged from his route, it took us over scenes, similar to his, of coral and volcanic islands. Soon after reaching Sydney, Australia, in 1839, a brief statement was found in the papers of Mr. Darwin's theory with respect to the origin of the atoll and barrier forms of reefs. The paragraph threw a flood of light over the subject and called forth feelings of peculiar satisfaction, and of gratefulness to Mr. Darwin, which still come up afresh whenever the subject of coral islands is mentioned. The Gambier Islands in the Paumotus, which gave him the key to the theory, I had not seen; but on reaching the Feejees, six months later, in 1840, I found there similar facts on a still grander scale and of more diversified character, so that I was afterwards enabled to speak of his theory as established with more positiveness than he himself, in his philosophic caution, had been ready to adopt. His work on "Coral Reefs" appeared in 1842, when my report on the subject was already in manuscript. It showed that the conclusions on other points, which we had independently reached, were for the most part the same. The principal points of difference relate to the reason for the absence of corals from some coasts, and the evidence therefrom as to changes of level, and the distribution of the oceanic regions of elevation and subsidence, topics which a wide range of travel over the Pacific brought directly and constantly to my attention." (Preface.)

* Corals and Coral Islands. By James D. Dana, LL.D. New York. Dodd & Mead, 1872. 8vo, pp. 398. With maps, plates and numerous woodcuts.

The chapters treat of "Corals and Coral Makers;" the "Structure of Coral Reefs and Islands;" the "Formation of Coral Reefs and Islands, and Causes of their Features;" the "Geographical Distribution of Coral Reefs and Islands;" the "Changes of Level in the Pacific Ocean;" and "Geological Conclusions;" with an Appendix, giving explanatory remarks on geological time, radiates, protozoans and a list of the names of species in the author's report on zoöphytes, the latter prepared by Professor Verrill.

While the first chapter gives an exhaustive and richly illustrated account of corals and coral polyps, we pass to some of the more general results of the author's studies. In speaking "a good word for coral reefs," the dread of navigators, he remarks that besides affording fishing grounds and harbors, "the wide coral banks and the enclosed channels greatly enlarge the limits tributary to the lands they encircle. Besides being barriers against the ocean, they are dikes to detain the detritus of the hills. They stop the water of the streams and cause it to drop the silt they were bearing off, and thus secure an addition to the land. They prevent, therefore, the waste which is constantly going on about islands without such barriers; for the ocean not only encroaches upon the unprotected shores of small islands, but carries off much of whatever the streams empty into it. The delta of Rewa on Viti Levu, resulting from the detritus accumulations of a large river, covers nearly sixty square miles. This is an extreme case in the Pacific, as few islands are so large and consequently rivers of such magnitude are not common. But there is rarely a coral-girt island which has not at least some narrow plains from this source; and upon them the villages of the natives are usually situated. Around Tahiti these plains are from half a mile to two or three miles in width and the cocoa-nut and bread fruit groves are mostly confined to them."

After having shown that atolls, and to a large extent other coral reefs, are registers of change of level, he shows that a large part of the Pacific Ocean must have undergone great oscillations in recent geological time. As proofs of elevation, he cites (1) "the existence on coral or other islands of patches of coral reef and deposits of shells and sand from the reefs, above the level where they are at present forming." (2) On islands not coral, the existence of sedimentary deposits, or layers of rolled stone, interstratified among the layers of igneous or other rocks constituting

the hills. "But the areas of subsidence, which covers an extent of fifty thousand square miles in the Pacific, and which commands so much interest from its bearings on geological questions, are indicated by" (1) "the existence of wide and deep channels between an island and any of its coral reefs; or in other words, the existence of barrier reefs; (2) the existence of lagoon islands or atolls; (3) the existence of submerged atolls; (4) deep bay indentations in the coasts of high islands as the terminations of valleys."

"Each atoll" says the author, "could we measure the thickness of the coral constituting it, would inform us nearly how much subsidence took place where it stands; for they are actually so many registers placed over the ocean, marking out, not only the sight [site] of a buried island, but also the depth at which it lies covered." As to the extent of the subsidence we are told—

"It is very evident that the sinking of the Society, Samoan and Hawaiian Islands has been small, compared with that required to submerge all the lands on which the Paumotus and the other Pacific atolls rest. One, two or five hundred feet, could not have buried the many peaks of these islands. Even the one thousand two hundred feet of depression at the Gambier Group is shown to be at a distance from the axis of the subsiding area. The groups of high islands above mentioned contain summits from four to fourteen thousand feet above the sea; and can we believe it possible that throughout this large area, when the two hundred islands now sunken were above the waves, there were none of them equal in altitude to the mean of these heights, or nine thousand feet? That none should have exceeded nine thousand feet in elevation is by no means probable. Hence, however moderate our estimate, there must be still allowed a sinking of many thousand feet. Moreover, whatever estimate we make that is within probable bounds, we shall not arrive at a more surprising change of level than our continents show that they have undergone; for since the Tertiary began (or the preceding period, the Cretaceous, closed) more than ten thousand feet have been added to the Rocky Mountains, and parts of the Andes, Alps and Himalayas.

Between the New Hebrides and Australia, the reefs and islands mark out another area of depression, which may have been simultaneously in progress. The long reef of one hundred and fifty miles from the north cape of New Caledonia, and the wide barrier on the west, cannot be explained without supposing a subsidence of one or two thousand feet at the least. The distant barrier of Australia is proof of great subsidence, even along the border of that continent. But the greatest amount of sinking

took place, in all probability, over the intermediate sea, called the "Coral Seas" where there are now a considerable number of atolls. The facts surveyed give us a long insight into the past, and exhibit to us the Pacific once scattered over with lofty lands, where now there are only humble monumental atolls. Had there been no growing coral, the whole would have passed without a record. These permanent registers exhibit in enduring characters some of the oscillations which the "stable" earth has since undergone."

While the island of Ponape is cited as affording evidence of a local subsidence in progress, the downward movement is not now general, and the period during which it took place "extends back to the Tertiary era, and perhaps still further back."

Geologists and palæontologists will be grateful for the grand generalization in the final chapter entitled, "Geological Conclusions." Facts bearing in an interesting way on lithology are stated in the section on the "Formation of Limestones," where the writer concludes that the "reef-formations illustrate that not only coral conglomerates, or *coral-rag* may be made of corals, but also the very finest and most compact unfossiliferous limestones; that fine compact limestone, as flint-like in fracture as any of Silurian time, is one of the most common of coral-reef rocks and is nothing but consolidated mud, or fine sand of coral origin."

These coral-reefs, which through subsidence became in some cases at least two thousand feet thick, are happily termed "beds of limestone with living margins," the living part furnishing material for its horizontal extension outward, and also, if a slow subsidence in progress, for its increase upward. "In the case of existing coral-reefs, there is yet no evidence that the species of the lower beds differ from those of the top. There is also no evidence, in any part of any ocean, that there is a set of cold water corals fitted to commence a reef in deep water and build it up to such a level that another set of species may take it and carry it up higher; the facts thus far gathered are all opposed to such an idea. Should it be hereafter proved that the corals of the inferior beds differ in species from those now existing, it will probably be found that the predecessors of those now living were also shallow water species; so that the subsidence in any case was necessary."

We now come to the solution of some questions bearing on the theories held by perhaps the majority of naturalists, that the present ocean beds were formerly continents. So far as we are

aware Professor Dana was the first* to call attention to this popular fallacy, which gives rise to so much crude theorizing to account for the present distribution of life and land on the surface of the globe. He shows from the fact "that the sediment or débris from a shore is almost wholly thrown back by the waves against the land where it originated, or over its submerged part in the shallow waters, and that is not transported away to make deep sea formations," the important conclusion that "lands separated by a range of deep ocean cannot supply one another with material for rocks. The existence of an Atlantic ocean continent—an Atlantis—has sometimes been assumed in order to make it a source of the mud, sand, and gravel, out of which the thick sedimentary formations of the Appalachian region of North America were made. But if this Atlantis were a reality, there would still have been needed, in addition to the presence of such an ocean continent, a set of freight carriers that could beat off the waves from their accustomed work, and push aside the ordinary oceanic currents; or else Atlantis would get back all its own dirt."

Professor Dana reasons from the existence of a Jurassic coral reef in England, that the "Gulf Stream has had, from the Jurassic period in geological history onward, the same kind of influence on the temperature of the north Atlantic ocean which it now has." Before the Cretaceous period began the waters cooled somewhat, as there were no coral reefs in the British Cretaceous sea, though as late as the Miocene Tertiary, there were reef corals in the seas of northern Italy.

"The absence from the American coast of the Atlantic, of any coral reefs of the Cretaceous beds, and of any reef corals, seems to show that the oceanic temperature off this coast was not favorable for such corals; and if so, then the line of 68° F. extended at least 20° further north on the European side of the ocean than on the Atlantic—an inequality to be accounted for only by the existence of the Gulf Stream. But, in addition, the whole range of life in the European Cretaceous, and its vastly greater variety of species leave no doubt as to the higher temperature of the ocean along its European border; so that the idea of a Cretaceous Gulf Stream must be accepted, and that of a Tertiary is demonstrated by similar facts.

If the Gulf Stream had its present position and force in Oölitic, Cretaceous, and Tertiary times, then the ocean had, throughout these eras, its present extension and oceanic character; and,

* Proceedings Amer. Assoc. Adv. Science, 1856.

further, no barrier of land extended across from South America to the Canaries and Africa, dividing the South from the North Atlantic, but all was one great ocean. Such a barrier would not annul entirely the flow of the Gulf Stream; yet the North Atlantic is so small an ocean, that if left to itself its system of currents would be very feeble."

We would have liked if space allowed to reprint the whole of the section entitled "The Oceanic Coral Island Subsidence." We reproduce portions, however, for the most part in the author's own words. While he has shown that coral islands are records of slow changes of level in the ocean's bottom, they are also records of the contour of the ocean bed, as they indicate submarine linear ranges of mountains "the whole over five thousand miles in length," the whole area of subsidence being over six thousand miles in length, with a width equalling that of North America, thus forming an example of one of the "great secular movements of the earth's crust." The subsidence was in progress during the Glacial era, while the more northern continental lands, "at least those of North America," were being elevated, preparatory to, or during that era of ice: and this elevation of land northward "may have been a balance to the *downward* oceanic movements that resulted in the formation of the Pacific atolls."

There was a similar subsidence in the West Indies. "The peninsula of Florida, Cuba, and the Bahamas look, as they lie together, as if all were once part of a greater Florida, or southeastern prolongation of the continent." Professor Dana believes that a very large number of islands, more than has been supposed, lie buried in the ocean, and he cites the interesting example of the "lonely Bermuda atoll." "Its solitary state is reason for suspecting that great changes have taken place about it; for it is not natural for islands to be alone."

We quote the following paragraph, believing, that it is the key to many of the laws of geographical distribution of plants and animals, as it opposes many crude theories of the existence of former continents and continental bridges which naturalists assume to account for the present distribution of life on opposite shores of our present continents:—

"While thus seeming to prove that all the great oceans have their buried lands, we are far from establishing that these lands were oceanic continents. For as the author has elsewhere shown, the profoundest facts in the earth's history prove that the oceans

have always been oceans. These lands in all probability were, for the most part, volcanic islands or summits of volcanic ranges, for of this nature are all the islands over the interior of either ocean that are not of coral origin."

The extracts we have given, rather than any words of the reviewer, attest the clear and comprehensive manner in which the author treats of a difficult and abstruse theme. The publishers have issued the volume in a most attractive style.

MAN IN THE PAST, PRESENT AND FUTURE.*— We are assured by the modest author of these lectures that their publication was the result of "the extraordinary favor which the public has hitherto manifested towards all the literary productions of the author without exception." They seem to be a digest, with liberal quotations, of the writings of Huxley, Schaffhausen, Vogt, Haeckel and others, on man and his origin. The main facts as to the antiquity of man are given, with a chapter on his simian origin, while the future of man occupies the last third of the book. We have not been able to find that the author is an original investigator in anthropology, and with his hearty contempt for philosophy and pity for any one who believes in such infantile notions forsooth as the immortality of the soul and the existence of God, we doubt whether his superficial mode of treatment is calculated to win the regard of his readers to anthropological studies.

The crude and sophomoric style of the third chapter is more subdued in those on the antiquity and origin of man. But even here in matters of detail the author is not invariably reliable. He accepts unhesitatingly the calculation as to the age of the portions of the human skeletons found in the "coral rock" of Florida, though it has been stated in this journal (vol. ii, p. 343, Oct., 1868) by M. De Pourtales, the original discoverer of the specimens, that they were not from a coral formation, but that he took them from a "fresh water sandstone on the shore of Lake Monroe, associated with fresh water shells of species still living in the lake. No date can be assigned to the formation of that deposit at least, from present observations." It has also been questioned whether the age of the bones found in the cypress swamps of Louisiana is so

* Man in the Past, Present and Future. A popular account of the results of recent scientific research as regards the Origin, Position and Prospects of the Human Race. From the German of Dr. L. Büchner, by W. S. Dallas. London 1872. Philadelphia. J. B. Lippincott and Co. 8vo, pp. 363.

well determined as Dr. Büchner seems to think. On the other hand he does not seem acquainted with the discovery of the human skull under Table Mountain in California, though these remains are probably more ancient than any human relics yet found in Europe.

Otherwise the work is a good digest of the leading facts and arguments on the scientific topics of which he treats, which the ordinary reader will not find in any available work.

The translation certainly does not gloss over the literary crudities of the original, while the book abounds in gross typographical blunders.

THE BIRDS OF THE TRES MARIAS AND SOCORRO ISLANDS..*—The Tres Marias form a group of several small, heavily wooded islands, situated off the Mexican coast, opposite the port of San Blas and about one hundred miles distant from that point. Socorro, the largest of the Revillagigedo group, is a barren volcanic island which rises abruptly to the height of two thousand feet, about three hundred and fifty miles southwest of the Tres Marias, and about the same distance from the Mexican coast. From their small size and their distance from the mainland, the fauna of these islands presents features of more than usual interest. Under the auspices of the Smithsonian Institution and the Boston Society of Natural History, Col. Grayson made several voyages to these islands for the purpose of exploring their natural history. In the present paper we have some of the results of Col. Grayson's labor, prepared from his notes and collections by Mr. George N. Lawrence. The paper contains copious and valuable notes respecting most of the species mentioned, with quite a full account of the physical characteristics of the islands. The Tres Marias list embraces fifty-two species, collected by Col. Grayson in 1865, 1866 and 1867. In general character the avian fauna of these islands closely resembles that of the adjoining main, though several strongly marked insular races are easily recognized, and is hence decidedly tropical. The only northern United States species recorded are such as have a wide range of distribution or are semitropical, the majority being raptorial birds. But one aquatic species (the sooty tern) is given,

*On the Physical Geography and Natural History of the Islands of the Tres Marias and of Socorro, off the western Coast of Mexico. By Col. Andrew J. Grayson. Edited by Geo. N. Lawrence, Proc. Bost. Soc. Nat. Hist. Vol. xiv, pp. 281-303. April, 1872. (Read June 7, 1871).

contrary to what one would anticipate, and the waders number only six species. Seven hummingbirds are reported, five being given by Mr. Lawrence on the authority of Capt. J. Xantus. The list is hence evidently more or less incomplete, Col. Grayson mentioning only such as he actually obtained or observed. Unfortunately no dates are given in the notes, and we are hence left in doubt as to the season of occurrence of the birds mentioned.

Socorro Island was visited twice by Col. Grayson, but the chief part of his collections there seems to have been made during the last ten days of May, 1867. The list embraces fourteen species, only five of which were found at the Tres Marias. Several appear to be known as yet only from this island,* and others only from this and the Tres Marias, though each has near relatives on the Mexican main. Among those of special interest obtained here were several specimens of Whitney's owl (*Micrathene Whitneyi* Coues) known formerly only from the single specimen obtained by Dr. Cooper at Fort Mohave, in 1861, but since found also at Mazatlan by Grayson, and in Arizona by Bendire.

The itinerary† given of Col. Grayson's voyages on these expeditions conveys a vivid picture of the dangers as well as annoyance, to which the enthusiastic naturalist is often exposed in the pursuit of his treasures. Though shipwrecked at Socorro, he seems not to have been daunted in his explorations, but extending his researches to other localities, he fell a victim to a fever contracted while collecting at the Isabel Islands, in the summer of 1869.‡ To Col. Grayson ornithologists are chiefly indebted for our present knowledge of the ornithological fauna of northwestern Mexico, and in his death science lost a devotee of rare zeal and industry. —J. A. A.

BOTANY.

Law of Angular Divergence in the Branches of Plants.— Mr. Thomas Meehan said that of all the problems that faced the botanist, few seemed more impenetrable than the law which governed the angular divergence in the branches of plants. Some grew quite prostrate and others, though closely allied species, might be strictly erect. At the present season of the year we may

* See Ann. Lyc. Nat. Hist. N. Y. x, pp. 1-18, March, 1871.
† Also published in the "Overland Monthly," September, 1872.
‡ See "Overland Monthly," February, 1870.

note plants with prostrate leaves or branches, which in spring will have them of a sharp, upright angle. The Verbascums at the present time, especially *V. blattaria*, had their root leaves so firmly pressed against the ground, that on lifting they would fall back with a spring; as soon as the central axis grew, the leaves from that would be almost upright. In some respects, erection or prostration became almost specific characters. The *Rubus villosus* usually grew erect even from infancy, and the *Rubus Canadensis* generally trailed; yet the last named would sometimes throw up strong erect stems, which could scarcely be distinguished in that stage from *R. villosus*. Again, the same species of tree would often produce individuals quite erect, and at other times very pendent, and hence we had in horticulture the class of weeping trees. All trees seemed to have this power of producing pendent individuals. The oaks, ashes, poplars, elms, all furnished familiar examples.

It was usual with botanists to pass these things over as "weaknesses." But the term weakness explained nothing. To say that these plants had lost the power of erection was simply restating the primary fact. Moreover, some of these prostrate forms had apparently more vigor than the erect ones. *Rubus Canadensis* was weaker than *R. villosus*, truly; but, on the other hand, some of the Russian trailing junipers were far more vigorous than any of the upright forms. The weeping beech also was in appearance more vigorous than the ordinary forms. All beeches had their young growth pendent. As the growth matured, the branches became erect; but in the weeping form erection did not come with maturity, and hence it remained pendent. In the ashes, however, there was no pendency in the young growth; but the "weeping ash" was one of the most decided of all drooping trees. In such cases as these, the law which governed the angles of divergence must either be different in each case, or operate at different stages of the development of the branches.

In his late travels in the Rocky Mountains, he came on a tract covered profusely with one of the small creeping Euphorbias, probably *E. cordata*, in which a large quantity grew perfectly erect. Sometimes only a portion of the plant exhibited this character, at other times all the plant was upright. The specimens he exhibited were of the erect class. In all these cases the plant was attacked by a small fungus, *Æcidium euphorbiæ*, the *Æ.*

hypericæfolia of Schweinitz. He thought that the fact that this little fungus should be able to make a usually creeping plant, rooting from every joint, entirely lose this character and become erect, was worthy of some notice by students in this branch of botany. — *From remarks made before the Philad. Acad. Sciences.*

Classification of the Gray Pine. — In the last edition of Gray's "Manual," the gray pine (*Pinus Banksiana* Lambert) is classed, according to Dr. Engelmann's arrangement of the species, with *P. inops* Ait. and *P. mitis* Michx., etc., in the group with the fertile catkins and cones lateral. Now, at Tawas Point, Michigan (Lake Huron), I find (June, 1872) this tree in an abundance of instances, with young, half-grown fruit, as well as others with female flowers, bearing them, one or a pair at apex, thus again a few inches lower down, and again farther down along that same branch.

It would be important to know how frequently the female flowers and the fruit are apical (*i. e.* above the leaves) and how often lateral. The facts here given would seem to require a correction in the classification of this tree, placing it, perhaps in an intermediate group, between the two groups already erected. Specimens sent by me to Dr. Engelmann have elicited his surprise as, though he had had plenty of material of *P. Banksiana* from Lake Michigan, he had none showing this disposition of the fruit.

The trees at Tawas Point are, for the gray pine, remarkably large; in many cases reaching the height of fifty feet, the trunk being frequently over a foot in diameter and occasionally eighteen inches through. The specimens collected, however, were from the more stunted usual form, ranging from five to twenty feet high, and which grow on the extremity of the point. I do not think the cones were either as frequently or as much curved as I have observed them to be on this tree further north, for instance at Marquette on Lake Superior.— Henry Gilman, *Detroit, Michigan.*

The Vegetable Nature of Diatoms.— The Rev. M. J. Berkeley notices in the "Academy" a memoir by Dr. Pfitzer on diatoms, which fully confirms the important observations which were made by Mr. Thwaites, and which "at once settled the question as to the vegetable nature of their singular organisms." The point of special interest in Pfitzer's paper is the elucidation of the mode in which the two portions of the outer silicious envelope

overlap each other, thus facilitating the multiplication of the individual as distinct from the fructification. Few matters are more interesting as regards microscopical observation than the mode of propagation, and when the different species of Biddulphia can be readily procured as on our southern coasts, they will afford ample food for many a morning's investigation. The two original halves remain exactly *in statu quo*, and it would be interesting to know how long they would subsist while new intermediate pustules are developed; and the same observation applies to many Desmidiaceæ.

Office of Bud Scales, etc. — Mr. Thomas Meehan referred to some observations made by him last spring before the Academy of Natural Sciences of Philadelphia in regard to the office of bud scales and involucral bracts. The general impression was that they were formed for the purpose of protecting the tender parts beneath. At that time he exhibited branches of *Fraxinus excelsior* on which some of the buds were entirely naked, and others clothed with scales in the usual manner. They could scarcely be for protection in this instance, as both were equally hardy.

He now had to exhibit an ear of corn which had been produced without the usual involucral bracts or husks, and yet was as perfect as if clothed in the usual way, showing that the husk was of not much importance as a protecting agent. An interesting point was that this ear had been formed on the end of a male panicle or tassel. It was not uncommon to find scattered grains of corn amongst male flowers, but a perfect ear like this he had never before seen. The ear was eight-rowed, and contained two hundred perfect grains. It was the variety known as "popcorn."

Seeds as Projectiles. — Mr. Thomas Meehan, at a late meeting of the Academy of Natural Sciences of Philadelphia, said that while travelling through a wood recently he was struck in the face by some seeds of *Hamamelis Virginica*, the common witch hazel, with as much force as if they were spent shot from a gun. Not aware before that these capsules possessed any projecting power, he gathered a quantity in order to ascertain the cause of the projecting force and the measure of its power. Laying the capsules on the floor, he found the seeds were thrown generally four or six feet, and in one instance as much as twelve feet away. The cause of this immense projecting power he found to be simply in the

contraction of the horny albumen which surrounded the seed. The seeds were oval and in a smooth bony envelope, and when the albumen had burst and expanded enough to get just beyond the middle where the seed narrowed again, the contraction of the albumen caused the seed to slip out with force, just as we would squeeze out a smooth tapering stone between the finger and thumb.

Alpine Flowers.—Dr. Parry, having devoted the whole summer to a third botanical exploration of the Colorado Rocky Mountains, has prepared beautiful sets of the more remarkable and novel Alpine flowers of the region, consisting of above a hundred species. A limited number of these sets, interesting as *souvenirs* of travel as well as to botanists, may be obtained for twelve dollars a set upon application to Dr. Parry at Davenport, Iowa, or to the Naturalists' Agency in Salem.—A. G.

ZOOLOGY.

The Zoological Station of Naples.—An undertáking which cannot fail to have an important influence on the progress of zoology has been started at Naples. A zoological station to be in charge of a permanent zoological observer and opened under certain restrictions to all workers who may wish to avail themselves of its facilities. It will form the natural complement of the advantages zoologists and anatomists now derive from the great zoological gardens of London and Paris, which constantly supply so much valuable material for study to the members of the Zoological Society of London and the Professors of the Jardin des Plantes. Hitherto all the work done on the seashore has necessarily been more or less interrupted; usually a stay of a few weeks at one place has been the utmost length of time which naturalists have been able to devote to one of the most fruitful branches of research in Zoology. Occasionally a more favored individual spends a few months on the seashore, but these are exceptions. All who have had occasion to pursue embryological studies on the seashore, or to trace the habits and study the anatomy of our marine animals, know how difficult it is to obtain just the material which is wanted. To make a complete embryology of a single marine animal often requires several years of unremitting devotion to one subject and, in order to obtain missing links, one must study on the

seashore what he happens to find. It is impossible to obtain certain stages of growth except at stated seasons, which are not always the time when the seashore is accessible. The value therefore of permanent stations cannot be overestimated. The zoologists in charge will little by little learn the habits of the more common species and by making the materials accessible to special research save an immense amount of time now devoted to exploring the ground. A zoological station on the seashore will become for biology, when fully equipped, the equivalent of first class observatories, and when other stations are established on well selected points along the coasts of different countries we may hope to gain the materials for the solution of many most interesting problems in Natural History which individual exertions could hardly hope to solve.

A better spot than Naples could not have been selected to make a start; rendered classic by the important memoirs which have been published upon the animals of its bay, the student will at once have a guide and models to follow.

May we not hope that the noble example given by Dr. Dohrn will be imitated in this country and that in connection with some of our leading Universities, Practical Schools of Biology will be established, where Professors and Students will find abundant material to pursue their favorite studies? — A. Agassiz.

The "Spener'sche Zeitung" (Berlin) publishes the following extract from a private letter: — On the narrow strip of coast which separates the park of the Villa Reale from the sea, a large stone building is at present being erected at Naples, quietly and almost unnoticed; at least the Neapolitan press has paid no attention to it. The strength of the foundations — it has taken three months to lay them — shows that they are intended for an edifice of considerable size and durability, and on making inquiries I have learned that this is the *Zoological Station* which has been occasionally mentioned by Italian, German and English journals during the last few months. It has been organized and is being built by a young German naturalist, Dr. Anton Dohrn of Stettin, who until a few years ago was a private teacher at the university of Jena. He has paid nearly the whole of the expenses, which amount to about 50,000 thalers (£7500) out of his own pocket, the only assistance he has received having come from a few personal friends, who have lent several thousands of thalers for the purpose. The following is a short sketch of his plan. The ground floor of the

building, which covers an area of about 8000 sq. ft., contains a great aquarium, which will be opened to the public. Dr. Dohrn hopes that the money thus obtained will not only suffice for all the expenses of the aquarium, but also afford a surplus to be employed in covering a part of the requirements of the upper story, which is to be exclusively devoted to scientific purposes. Besides the officials and servants employed in the aquarium, several young zoologists will be attached to the station and receive a regular salary from the Director, Dr. Dohrn. Thus a number of new positions will be opened up for young scientific men. But this is not all. As the only duty of these zoologists will be to devote themselves to certain branches of scientific work, and their exertions will be carefully directed and organized, as has long been the case in astronomical and meteorological observatories, there is every reason to hope that scientific research will be greatly facilitated and advanced by their labors. In the upper story of the Zoological Station, laboratories will also be prepared for the use of naturalists coming from other parts of Italy and from abroad. For this purpose a large scientific library will be founded, Dr. Dohrn's very considerable private collection serving as a nucleus; and about twelve tables fully furnished with the necessary appurtenances established. Each of the latter will be provided with a number of tanks supplied with a constant stream of sea-water. Sea fishing and dredging will be conducted on an extensive scale by means of several boats to which, if the necessary means are forthcoming, a small steam-yacht wi l be added. The animals taken will be given to the zoologists for scientific treatment. It is more than doubtful, whether all these rich and expensive conveniences can be furnished to zoological visitors without any pecuniary compensation, but I hear that Dr. Dohrn has drawn up a plan which will enable even naturalists of limited means to enjoy the advantages of the Station. He proposes to offer one or more tables to various Governments and scientific societies for a fixed annual sum. These tables and all the scientific resources of the Station will at once be placed at the disposal of any naturalist who brings a certificate from the government, university, or scientific body to which the table has been let. This plan, among its many other advantages, seems to be a successful attempt to solve the difficult question as to how it is possible to unite a complete self-administration on th part of scientific bodies with the reception of pecuniary assistance

from their Governments. Dr. Dohrn speaks in the most grateful manner of the assistance rendered him by the German authorities in Italy, especially by Mr. Stolte, the Consul-General at Naples, while at the same time he warmly acknowledges the interest in his undertaking, displayed by the government of Italy, more particularly by Signor Correnti and Signor Sella, the late and the present minister of Public Instruction. The difficulties in the way of the execution of his plans were neither few nor small, as may be gathered from the fact, that in spite of the readiness displayed by the municipal authorities of Naples, more than two years elapsed before a definitive contract could be concluded between the town and Dr. Dohrn with respect to the cession of a suitable site for the building.

[We are happy to add our testimony to the great value and importance of such a biological station as this. Late in May one of the editors of this journal visited the foundations of the Naples aquarium, and was surprised at the magnitude of the building, and the admirable natural advantages of the situation, and he predicts a grand success to the undertaking; the Italian government will undoubtedly cherish and protect the institution when its value shall be demonstrated. We hope that the success of this station may lead to the establishment of a zoological station on the American coast. Surely the zeal and money would not be wanting with us, if some one would take the lead; and such a station properly conducted and with due regard to popular wants, would be undoubtedly self sustaining. Indeed it is not a little surprising that public aquaria and zoological gardens on a large scale have not been established in the United States before this, as those of London, Paris, Hamburg, Berlin, etc., are, we believe, well sustained. — Eds.]

Faunal Provinces of the West Coast of America. — At a recent meeting of the California Academy of Sciences, Mr. Stearns called the attention of the members to certain provincial divisions in the marine faunæ of the west coast of America suggested by Prof. Verrill in the Transactions of the Connecticut Academy of Sciences for 1871.

Mr. Stearns remarked, more particularly regarding the coast from Cape St. Lucas northward, that to divide this portion upon the data at present made known, so as to make provinces which should correspond with those of the Atlantic side, is not warranted

by the knowledge possessed at the present time ; that the topography and geology of that portion of the west American coast, specified by him, was much more uniform in its character, as well as in the temperature of its waters, than that of a corresponding section in extent of the Atlantic coast, to say nothing of the influence of the coast currents which upon our coast are peculiar, and which enter largely in the matter of distribution of species ; furthermore that the manuscript data in his possession, which were, to say the least, fully as important as what had already been published, and quite likely more authentic, indicated a greater range of coast to each province and therefore a less number of provinces than suggested by Prof. Verrill.

Though much had been done by himself, and other members of the Academy cooperating with him, in the accumulation of data bearing upon the geographical distribution of the mollusca of our coast, still so much remained to be done in order to make the work thorough and reliable, that it would be merely arbitrary and necessarily require frequent readjustment to propose at this time any new divisions or subdivisions of the coast into zoological provinces.

As to that part of the west coast of North America from Cape St. Lucas, including the Gulf of California, thence southerly to a point a few miles south of Panama, with the exception of collections made at a few places in the Gulf of California, also at San Juan del Sur and its immediate vicinity on the coast of Nicaragua, and in the Bay of Panama, almost nothing more is known of this vast reach of shore line than was known years ago.

Mr. Stearns stated that at some future time, as soon as the data collected by himself and colaborers here could be compiled, he proposed to refer to this subject again.

On Zoological Barriers, with Special Reference to South America.—How far the present lofty mountain-chains and broad rivers arrest dispersion is an interesting and important question. Every fact throwing light upon it is a valuable contribution to science. It would seem that in temperate regions the mountains are greater barriers than in the tropics. Mr. Darwin says that we ought not to expect any closer similarity between the organic beings on the opposite sides of the Andes than on opposite shores of the ocean. My own observations on the equatorial Andes corrobo-

rate this statement, though it is more strikingly true of the Chilian Cordilleras and, as Mr. D. has remarked, is truer of quadrupeds and reptiles than of birds and insects. I know of fifty-six species occurring on both sides of the Andes of Ecuador, excluding all highflying Accipiters and all species ranging north of Panama.

Of Mammals, one monkey and one pachyderm; of Birds, one thrush, two wrens, one vireo, five tanagers, two antcatchers, two flycatchers, five hummers, one trogon, one sawbill and one wader; of Reptiles, ten ophidians, two saurians and one batrachian; of Insects, seventeen lepidopters; of Mollusca, three Bulimi.

The Amazons, the Rio Negro and the Madeira divide the great plain into four districts, apparently similar in vegetation, climate, etc. Yet these rivers act as barriers to several species, and native hunters, understanding the fact, cross the river to procure certain animals. Five species of monkeys are confined to the north bank of the Amazons, and two to the south side. The blue macaw, green jacamar and curl-crested toucan never cross the Great River, though butterflies are known to fly over it. What is the cause of this isolation? Not the forest, for there is not a single tree which is not found both on the northern and southern banks. — Prof. JAMES ORTON.*

ABSENCE OF EYES IN CLASSIFICATION. — Dr. Hagen's objection to the generic estimation of the lack of visual organs in the cave crustaceans is even less weighty than I had supposed; viz., the fact that in certain cave insects, the female sex only is deprived of eyes, the males possessing them. No one knows better than Dr. Hagen, that in many genera and even families and higher groups of insects the definitive characters are only to be found in the male sex; and I believe that in some crustaceans it is the female which exhibits the greatest departure from the embryonic starting point. In each case the most extensively developed sex must of necessity furnish the characters which determine the status of the species. But it is unnecessary to refer to special cases of this kind, for as I have already shown, the developmental status of the eyes in the blind catfish is very variable in both sexes and opposite sides of the head. This would have been a far better reason for rejecting the recognition of this character as generic. But on

* Abstract of a paper read at the American Assoc. Adv. of Sci., 1872.

the same grounds we must reject *all* characters now regarded as generic, for there is scarcely one which cannot be found to be variable in some species in some more or less remote region of the animal kingdom, recent or extinct. Hence, as I have often urged, it is the *constancy* of a character in the group of species where it exists that determines its value. This is the philosophy of universal custom. The same remarks may apply to my *Orconectes inermis*. Though I could not make it agree with Dr. Hagen's second form of *O. pellucidus*, it may be such, as Dr. Hagen's knowledge of these animals is much greater than mine, and I would at once accept his determination in the case. But what are these "forms"? If inconstant they are only varieties; if constant, species.—EDWARD D. COPE.

VITALITY AND SEX.—Prof. Riley mentioned at the meeting of the American Association a few interesting entomological facts in support of Dr. Hartshorne's paper, and to show that in some way or other the male element is connected with defective vitality. In studying *Phylloxera vastatrix*, or the grape-root louse, he had always found the male pupæ most abundant on such roots as had been most depleted and where the insects were already beginning to die off for want of sufficient nutrition.

In the common oyster-shell bark-louse of the apple tree (*Mytilaspis conchiformis*), which had been increasing and spreading for many years past in the northwestern states, something similar occurred. The male of this species had been sought in vain for a quarter of a century both by entomologists and horticulturists; and they were forced to the conclusion that the species multiplied agamically and despaired of ever finding the male. But for the past three or four years this insect has been rapidly dying out in those sections where it once flourished, until at last it is no longer dreaded by the orchardist. Under these conditions of lessened vitality the male element suddenly appears, and Mr. Riley had the satisfaction of discovering it the present summer.

"SPIKE-HORNED MULEDEER."—In the July number of the NATURALIST, Prof. E. D. Cope refers to a supposed specimen of a spike-horned muledeer (*Cervus macrotis*) obtained in Kansas. Without questioning the probable occurrence of "spike-horns" in *C. macrotis*, the size of the horns mentioned by Prof. Cope seems to render the reference of the specimen in question to *C. macrotis* somewhat

open to doubt. The length of the spike in this case is said to be two feet and a half, which is enormous when it is considered that the fully developed antlers of old bucks of this species rarely much exceed two feet, measured along the curvature of the beam to the end of the longest point. On the other hand, it is just such a spike as is usually developed in a two-year old buck elk (*C. Canadensis*), an animal also common in Kansas along the Kansas Pacific Railway.

The occurrence of spike-horned bucks in *C. Virginianus*, which has of late attracted so much attention, seems in no way remarkable. Prof. Baird, in writing of the *C. Virginianus* in 1857, says, "Sometimes a perfectly adult, full-grown male will have but a single slender spike, thus resembling the buck of the second year." (Mam. N. Amer., p. 647.) — J. A. A.

Since the above was written I have learned from Prof. Cope that he at first also regarded the horns as those of a two-year old elk, and only referred them to *C. macrotis* on being assured that the elk did not occur at the locality (Fort Hays, Kansas) where these horns were obtained. From personal knowledge, however, I am able to affirm that the elk is of quite common occurrence within a few miles of Fort Hays.—J. A. A.

The Rattle of the Rattlesnake. — At a meeting of the Essex Institute in May last Mr. F. W. Putnam gave a description of the structure of the horny appendage to the tail of many snakes, especially developed in the genus of Rattlesnakes, and controverted the idea of natural selection having anything to do with its peculiar development. He also thought that the supposition that the rattle was a benefit to the snake, as a means of enticing birds, by its sound imitating that made by the Cicada, as suggested by a writer in a late number of the Naturalist, could not be accepted. The Cicada, during the few weeks that it existed in the adult state, at which time the males made their peculiar drumming, was not a ground insect, and was not very abundant, even among the trees, in such localities as were most frequented by the rattlesnake. Secondly, the sound made by the snake was very slight under ordinary circumstances, and the rattle was not sounded to any extent unless the snake was disturbed by some cause. His own observations on these snakes, in their natural habitat, led him to believe that it was not at all their nature to

set up a rattling for the sake of enticing birds to them, but that they would slowly and cautiously approach their victim, or else lie in wait ready to give the fatal spring upon anything that came near. He believed that the rattle was in reality a detriment to the snake, except in so far as it served to call the sexes together, which he thought was most likely its true function.

Flies as a Means of Communicating Contagious Diseases.—Prof. Leidy remarked at a late meeting of the Academy of Natural Sciences of Philadelphia, that at this time, during the prevalence of small pox, he was reminded of an opinion he had entertained that flies were probably a means of communicating contagious disease to a greater degree than was generally suspected. From what he had observed in one of the large military hospitals, in which hospital gangrene had existed, during the late rebellion, he thought flies should be carefully excluded from wounds. Recently he noticed some flies greedily sipping the diffluent matter of some fungi of the *Phallus impudicus*. He caught several and found that on holding them by the wings they would exude two or three drops of liquid from the proboscis, which, examined by the microscope were found to swarm with the spores of the fungus. The stomach was likewise filled with the same liquid, swarming with spores.

GEOLOGY.

Extinction of Birds in Mauritius, etc.—I believe I have demonstrated, by the examination of the bones which have been found in the recent deposits in the Mascarene Islands, and which belong, for the most part, to extinct species, such as the dodo, the solitaire, the aphanapterex (*Fulica Newtoni*), large parrots, etc., that these islands have once been part of a vast extent of land, that these lands, by little and little and by a slow depression, have been hidden under the waters of the ocean, only leaving visible some of their highest points, such as the islands of Mauritius, Rodriguez, and Bourbon. These islands have served as a refuge for the last representatives of the terrestrial population of these ancient epochs; but the species, confined in too limited a space and exposed to all causes of destruction, have disappeared by degrees; and man has in some measure aided in their extinction.

Madagascar evidently was not in communication with these islands; for when Europeans visited them for the first time, they

did not find there any Mammalia, with the exception of some large bats; none of those remarkable Lemuridæ peculiar to the fauna of Madagascar existed in the Mascarene Islands. The study of fossil birds leads to the same result; and three species of Æpyornis which Mr. A. Grandidier and I have been able to recognize among the fossils collected in the swamps of the south-west coast have enabled us to establish the relationship which connects these birds with the Dinornis, the Palypteryx and Aptornis of New Zealand. All these species belong to the same zoological type, and make us feel that at a more or less remote epoch there may have existed some communication between these lands so far away from one another; perhaps groups of islands, now submerged, formed intermediate stations, of which unfortunately we have no trace. — A. Milne-Edwards, *from American Journal of Science and Arts.*

The Eocene Genus Synoplotherium.— This genus rests on a single species of about the size of a black bear, from the southern Wyoming Eocene. Many parts of the skeleton are preserved, and furnish the following characters. The toes of the fore foot are four, the outer materially shorter than the others; the claws flat, ovate, and deeply fissured above; the tail slender; the head with a flat muzzle with anterior nareal exposure and premaxillary bones much contracted below, and with a wide lateral vertical groove. Immediately behind this projects a huge canine tooth, and the outer face of the outer incisor is exposed in its bottom. There are three upper incisors, the median two much smaller than the external, which is as large as many canines. The mandible had six molars, the last shorter than the penultimate. They are separated by a toothless interval from the incisors, which are very large and directed upwards and forwards like those of a rodent. They oppose the outer incisors at the extremity, and the canine superiorly and laterally, performing thus a double service.

This form is evidently allied to the genera Anchippodus of Leidy and Psemotomus Cope, as well as to the larger Loxolophodonts and are either forms of Proboscidia or represent those connecting this group with the Perissodactyla. They are thus of interest, and their full analysis cannot fail to be of value to zoology — Edward D. Cope,* A.M.

* Read at the Dubuque Meeting of the American Association for the Advancement of Science, Aug., 1872.

Glacial Action in Fuegia and Patagonia.—Professor Agassiz of the Hassler Expedition, as we find in the "American Journal of Science and Arts," gives an interesting account of land ice action in these countries, describing rounded and polished rocks, boulders, and glacial scratches. Prof. Agassiz concludes from the character of the north and south sides of the summits in Fuegia, and from other facts, that the movement of the ice was towards the north, and independent mainly of the present slopes of the land. The region over which he states that he observed glacial phenomena in southern South America includes all of the continent south of 37° of south latitude both on the Atlantic side (Bay of St. Matthias) and the Pacific side.

New Land Shells from the Coal Measures.—Prof. F. H. Bradley describes and figures in the August number of the "American Journal of Science and Arts" two new land shells from the coal formation of Illinois. It will be remembered that Dr. Dawson found many years since a pupa (*P. vetusta*) in the same formation in Nova Scotia. The new pupa is called *Pupa Vermilionensis*. The other shell, referred by Messrs. Meek and Worthen to a marine family (Rotellidæ), Mr. Bradley considers as a helicid, and describes it under the name of *Anomphalus Meekii*.

ANTHROPOLOGY.

A Remarkable Indian Relic.—Having a few days of leisure, I started on Monday last, in company with my friend, J. F. Bly, Esq., to visit the fish-breeding establishment of Jazael Robinson at Meredith Village, N. H., hoping to make some pleasant additions to my rather limited knowledge of Natural History, to refresh the memories of beautiful scenery about the lake, and breathe again the air of the mountains.

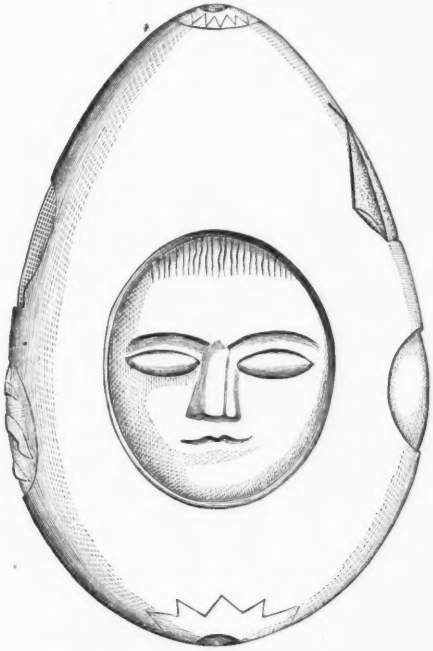
The process of fish breeding and raising was elucidated by our guide with so fascinating an interest that we ceased to wonder at the prevalence of "fish fever." Some five thousand trout in the lower pond were a foot or more in length and ravenous for something to bite. A finger held within an inch of the surface was sure to be jumped at and seized — as was a gentleman's nose which happened incautiously to be held too near the water.

On returning to the village we inquired for any object of scientific interest which might be worth seeing, and were told at once of

a wonderful sculptured stone which had been found the week before by some workmen of Mr. Seneca A. Ladd. As Mr. Ladd is quite a naturalist, and has already an extensive private collection of relics and specimens, he was delighted with the new discovery, and exhibited and explained the really remarkable relic with an enthusiasm which only the genuine student can feel.

The stone was found at a depth of about two feet, in the sandy

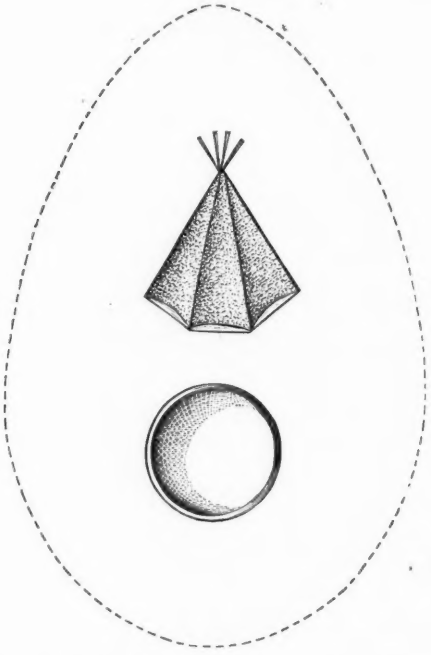
Fig. 139.



drift at the head of the lake, where the ground apparently had not been disturbed for centuries. The location is at the point where Lake Waukewan ("Measly Pond") originally emptied into Lake Winnipiseogee, and was, no doubt, a favorite fishing ground for the primitive tribes that formerly inhabited that region. The water has been diverted from this channel, and now flows through a canal furnishing the remarkable water power of forty feet per-

pendicular fall, which carries on the hosiery and other manufactories here. About the first of June Mr. Ladd was causing the digging of post holes for a fence, when one of the laborers threw out what was apparently a lump of clay some six inches in thickness. The occurrence of such a body in this soil attracted Mr. Ladd's attention, and a slight examination revealed a section of the stone. After a careful cleaning process, with water and

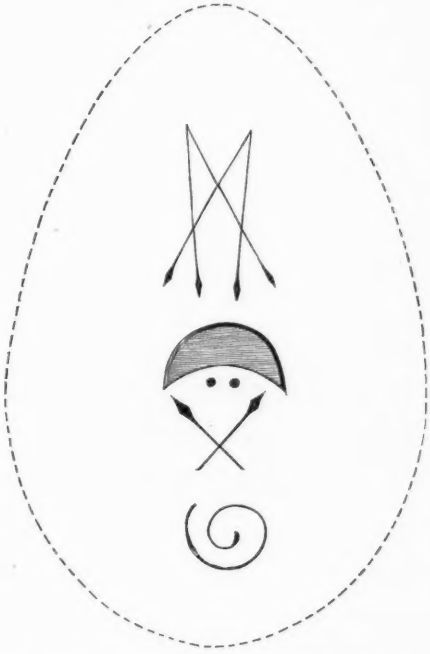
Fig. 140.



brushes, the coating of clay was removed and he was delighted to find himself in possession of as interesting an archæological relic as yet found in New England. It is not to be wondered at that he takes pride in showing it, and preserves it with the greatest care. We were kindly allowed to make sketches of it, and have had the illustrations engraved to which we shall refer.

The stone is of an oval form, smoothly finished upon the surface, and of as perfect contour as if turned in a lathe. Its dimensions are $3\frac{7}{8}$ inches in length and $2\frac{3}{8}$ inches in thickness. The material is a silicious sandstone of a greenish clay-drab color and of fine grain. The sculptures are mostly in bas-relief, upon a ground sunk below the surface of the stone and of a higher grade of art than usual in Indian workmanship. It is difficult to con-

Fig. 141.

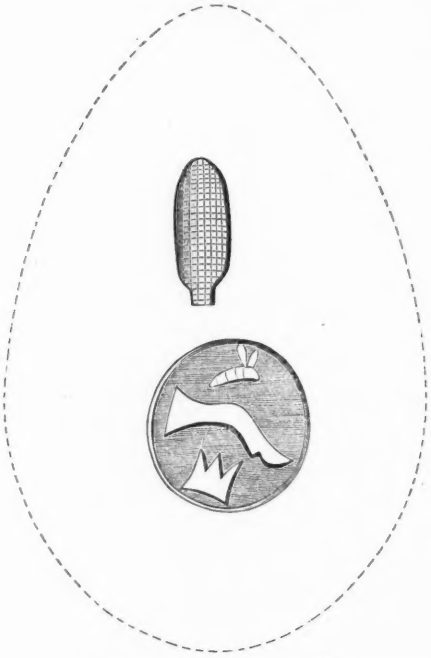


ceive that such work could be done without the aid of metal tools. A hole was drilled through the longest diameter which tapered uniformly from $\frac{3}{8}$ of an inch at the larger end to $\frac{1}{8}$ at the smaller, the use of which was probably the same as in the class of stones known as "gorgets," to which we should refer it. Around the aperture at each end was a border of points like a star, as will be seen by figure 139.

Figure 139 is intended to give an idea of the form of the stone, the figures at the sides being the profiles of Figs. 140 and 142. The Indian 'mask' has the characteristic outline and projecting mouth seen in other specimens of Indian art. The wavy lines on the forehead are supposed to indicate the hair. The finish of the whole is quite elaborate.

In figure 140 the dotted line is intended to indicate the position

Fig. 142.



of the picture on the stone. The lines of the 'wigwam' are regularly drawn, and the surface is "pricked up" or roughened. The circle below is perfectly rounded and supposed to represent the full moon, although every one has the privilege of forming his own theories in regard to the significance of the symbols.

Figure 141 has a delineation of four 'arrows' inverted. Underneath this is a 'new moon,' and two round dots that may repre-

sent 'stars.' Below this are two 'arrows' crossed and a convolute or coil which may be a 'serpent.'

Fig. 142 shows an 'ear of corn,' nicely cut, and in a depressed circle are three figures, the central one representing a 'deer's leg,' and the others of doubtful interpretation.

As an illustration of the surmises of those who are interested in deciphering such inscriptions we give the following, which is certainly ingenious and even plausible.

It is suggested that the stone commemorates a treaty between two tribes. The reversed arrows in Fig. 141 symbolize peace; the moon and stars the date; the crossed arrows a union of the two forces for aggressive or defensive purposes, etc. The wigwam might indicate the place where the treaty was consummated, and the corn and other emblems the feast by which it was commemorated.

It is to be hoped that the stone, or, at least, casts and photographs of it, may find their way into our collection at Salem. — D. J. Tapley.

The Boomerang.—The earliest inhabitants of the globe as they spread themselves over the earth, would carry with them the rudiments of culture which they possessed, and we should naturally expect to find that the most primitive arts were, in the first instance, the most widely disseminated. Amongst the primæval weapons of the Australians I have traced the boomerang, and the rudimentary parrying shield — which latter is especially a primitive implement — to the Dravidian races of the Indian peninsula and to the ancient Egyptians, and although this is not a circumstance to be relied upon by itself, it is worthy of careful attention in connection with the circumstance that these races have all been traced by Prof. Huxley to the Australoid stock, and that a connection between the Australian and Dravidian languages has been stated to exist by Mr. Morris, the Rev. R. Caldwell, Dr. Bleek, and others.* And here I must ask for one moment to repeat the reply which I have elsewhere given to the objection which has been made to my including these weapons under the same class, "that the Dravidian boomerang does not return like the Australian weapon." The return flight is not a matter of such primary importance as to constitute a generic difference, if I may use the expression, the utility of the return flight has been greatly exaggerated; it is

* Journal of the Anthropological Institute, No. 1, vol. i, July 1871.

owing simply to the comparative thinness and lightness of the Australian weapon. All who have witnessed its employment by the natives, concur in saying that it has a random range in its return flight. Any one who will take the trouble to practise with the different forms of this weapon, will perceive that the essential principle of the boomerang, call it by whatever name you please, consists in its bent and flat form, by means of which it can be thrown with a rotatory movement, thereby increasing the *range and flatness of the trajectory*. I have practised with the boomerangs of different nations. I made a *fac simile* of the Egyptian boomerang in the British Museum, and practised with it for some time upon Wormwood Scrubs, and I found that in time I could increase the range from fifty to one hundred paces, which is much farther than I could throw an ordinary stick of the same size with accuracy. I also succeeded in at last obtaining as light return of flight; in fact it flies better than many Australian boomerangs, for they vary considerably in size, weight and form, and many will not return when thrown. The efficacy of the boomerang consists entirely in the *rotation*, by means of which it sails up to a bird upon the wing and knocks it down with its rotating arms; very few of them have any twist in their construction. The stories about hitting an object with accuracy behind the thrower are nursery tales; but a boomerang, when thrown over a river or swamp will return and be saved. . . . . To deny the affinity of the Australian and Dravidian or Egyptian boomerang on account of the absence of a return flight would be the same as denying the affinity of two languages whose grammatical construction was the same because of their differing materially in their vocabularies. —*From the Address of Col. Fox before the Anthropological Section of the British Assoc. Adv. Sci., Aug.*, 1872, *in* "*Nature.*"

Antiquity of Man in France.— The International Congress of Anthropology and prehistoric Archæology held its sixth meeting at Brussels in August last. The editor of "La Revue Scientifique" thus notices what had been done in France and Belgium to establish the high antiquity of man. "Indeed, if in France there was announced for the first time in 1829, by three southern geologists, De Christol, Tournal and Emilieu Dumas, the astounding proposition that man was living at the same time as the great animals of lost species whose bones fill the soil of caverns; if it

is to the indomitable perseverance of a French savant, Boucher de Perthes, that we have seen this proposition become established in science; if it is to the regretted Thompsen and other savants of Scandinavia that we owe the first attempts of a classification of these times forgotten by history; it is a Belgian, Schmerling, who has definitely demonstrated, and placed beyond controversy, the proposition of our geologists of central France. In 1834 he showed that in the caverns of the province of Liége there existed some very ancient land slides which had recovered some palæontological beds with human bones, these having been thus removed from all subsequent handling, so as to place the contemporaneity of the débris they contained beyond all doubt.

MICROSCOPY.

Classification of Microscopic Objects.— Dr. James Murie, of Middlesex Hospital, England, has contributed two elaborate papers on this subject to the Royal Microscopical Society.

In the arrangement of objects in a microscopical cabinet he adopts the following excellent rules, which are equally applicable to any system of classification. 1. Do not needlessly multiply similar specimens. 2. Do not, on feeble grounds, separate naturally allied objects. 3. Maintain, as far as possible, a uniform style of nomenclature and size of slide. 4. Endeavor to place in the cabinet good typical specimens well prepared. 5. Reject all lumber, which only weakens a collection.

In arranging objects belonging to the organized kingdoms, it is customary to begin with a series of elementary tissues, either preceding the main collection with this, or developing it from this. Thus advise the writers on histology, and thus are arranged the great histological collections. Such a classification, which may be advisable in collections (as in books) used for teaching the elements of histology, and in small private collections where little more than types of the different kinds of cells are present, is unnecessary in large collections designed for consultation and reference by those who are somewhat familiar with the primary elements, and undesirable from causing an unnecessary duplication of specimens and from marring the general harmony and sequence of the grouping. The elementary tissues can generally be conveniently arranged along with the organs they help to build up; or, at most,

each natural kingdom may be preceded by a few typical slides illustrating, not exhaustively, the material of which it is built.

In the mineral kingdom, micro-chemicals precede micro-minerals, but there seems to be no gradation of minute forms upon which a classification could rest. The systems employed in the text-books may therefore be followed. Polarizing objects form a convenient subsection. Several specimens of the same substance may be arranged geographically. There should be no microscopical geology, but its subjects should be scattered through the general collection according to their biological relationships. To every natural division should be appended a series illustrating its application to the arts and manufactures, showing its utility, purity, adulterations, etc.

In the vegetable kingdom the natural orders should, as far as possible, regulate the general arrangement, while the subsidiary divisions should be of a physiological character. Often the lower organisms can be viewed in their completeness in a single slide, while the higher can only be illustrated by a succession of subseries. The lower forms, almost up to the ferns, should be primarily grouped according to their genetic affinities, the subdivisions being physiological. The higher forms, however, monocotyledons and dicotyledons, should be primarily divided physiologically, according to organs and apparatus, the secondary divisions being dependent on genera, families, etc. Thus the roots, stems, flowers, etc., must be grouped together and not separated that each genus may be separately illustrated. Fossil forms should be placed with the rest. Specimens of unknown affinities may be arranged geologically, geographically or according to their economic value. Teratology should follow physiology. Fabrics, adulterations, etc., should conclude the series.

The animal kingdom should be arranged on the same general principles as the vegetable kingdom.

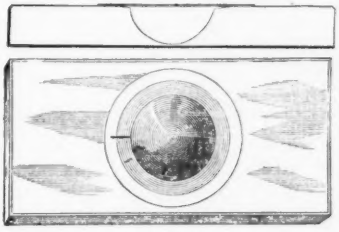
The cabinets for the retention of objects are best made small and in a cubical form so that any number of them may be piled up to form a large cabinet. The slides should lie flat in drawers containing but a single layer. Some of the English opticians sell cabinets of polished deal, which are a cheap and excellent substitute for the elegant mahogany cabinets ordinarily used. When greater cheapness is required, trays of tin or of pasteboard may be used, piled up in boxes of convenient size according to the plans

of Mr. Henry George and Mr. Piper. The cabinet may be furnished, at the bottom, with some deep drawers for the reception of large objects in deep cells; the heavy objects thus brought together being represented in the classified collection by blank slides properly numbered and labelled, and referring to the drawer in which the object is to be found. Slides not exceeding three inches square are easily arranged in the regular drawers, and if any exceed three inches they should still be placed in their proper position, the partitions being cut away so as to allow them to occupy a double interspace.

A Life Slide.—The accompanying engravings represent front and side views of a form of life slide for the microscope, designed and used with much success by Mr. D. S. Holman. It is constructed to retain the greatest quantity of material under the smallest cover glass, and is designed to be used with the highest powers of the microscope for studying the Bacteria, Vibriones, and other very low forms of life.

The slide consists, as will be seen from the cuts, of a central polished cavity, about which is a similarly polished bevel; and from the bevel outwards extends a small cut, the object of which is to afford an abundance of fresh air to the living beings within, as well as to relieve the pressure, which shortly would become so great, from the evaporation of the liquid within, as to cause the destruction of the cover glass.

Fig. 143.



No special dimensions are stated for the central cavity. The bevel is usually $\frac{1}{8}$ inch in diameter (the cut is $\frac{2}{3}$ of natural size); the small canal is cut through the inner edge of the bevel or annular space, outwards, for the purpose named above.

It is found, upon enclosing the animalculæ, etc., that they will invariably seek the edge of the pool in which they are confined, and the bevelled edge permits the observer to take advantage of this disposition; for when beneath it, the objects are within range of the glasses of high power.

Another very important feature in the device is the fact that a

preparation may be kept within it, for days or weeks together, without losing vitality, owing to the simple arrangement for supplying fresh air.

We have repeatedly had the opportunity of witnessing the use of this slide, and are convinced that nothing of the kind has yet been devised which can equal it in excellence, either for observing or generating the lower forms of life.—*Journal Franklin Institute.*

To Blacken Brass.—The following methods are given by anonymous correspondents in the "English Mechanic and World of Science." Though not new they will be useful to readers, who desire to give a dead-black finish to adapters, diaphragms, etc. Warm the brass over a gas flame or spirit lamp, and plunge it while hot for two or three seconds into nitric acid. Then heat again until it blackens, brush off the blisters, and lacquer if a lustrous surface is desired. Instead of the nitric acid the following fluid may be used: a mixture of two parts of arsenious acid, four parts of hydrochloric acid, one part of sulphuric acid, and eighty parts of water.

Monochromatic Sunlight, by Means of Glass Plates.—Mr. J. Edwards Smith, of Ashtabula, Ohio, has obtained light with which he is perfectly satisfied by means of a light sky-blue and darker green glasses. He prefers to use one blue glass combined with two or three green ones, the best shades being ascertained by trial. Several such sets, of different depths of color, may be mounted in a series, like magic lantern pictures, so that either set can be brought easily over the hole in the shutter. By sunlight transmitted through such a combination of glasses, and without condenser or apparatus of any other kind, he "resolves" all the shells of the Probe Platte with perfect ease. He considers the light thus modified as good as the more nearly monochromatic light of the troublesome ammonio-sulphate cell.

An Optical Experiment.—A correspondent of the "Scientific American" thinks the photographic camera might be a means of gaining an unlimited magnifying power. He would photograph an object and then take a series of enlarged views, each one representing on an enlarged scale, a portion of the preceding one. Evidently he is not accustomed to the use of magnifying powers.

Camphor in Paraffin Lamps.—Mr. John A. Perry, of Liver-

pool, calls attention to the fact that about fifteen grains of camphor added to the paraffin in an ordinary sized lamp about an hour before using, will greatly increase the brilliancy of the light.

Mounting Small Objects in Balsam.— A correspondent in the "English Mechanic and World of Science," who has been troubled by the balsam washing away from the centre of the slide small objects, such as starch grains and diatoms, advises that the balsam be placed on the slide in the form of a ring around the object, so as to run in upon it from all sides and not drift it away. A better contrivance is to wet the object and allow it to dry upon the slide, after which it will not easily be misplaced. A trace of gum arabic may be added to the water if, as will seldom be the case, it should be found necessary.

Bone Dust in Soap.— If any kind of soap seems irritating to the skin, particularly the cheaper kinds of "Old Brown Windsor," try the microscope for the detection of fine particles of ground bone which have not been separated from the fat of which the soap was made.

The Fresh Water Polype. — Mr. James Fullagar gossips pleasantly about the *Hydra vulgaris* in "Science Gossip." He has no difficulty in multiplying his specimens by cutting up the animals; though the parts do not lead an equally favored life, for the head-part proceeds to eat immediately, while the stalk is obliged to wait patiently several hours, fasting, until a new head and tentacles are developed. The polypes contracted and dissolved into a confused mass of granules in December. None could be found during the winter, but very small ones appeared in the spring, and still later these assumed a large size and began to multiply by budding. The earliest that appeared, much smaller than those produced by budding, he believed to be produced from eggs, though their origin escaped him, as it had escaped previous observers.

Reproduction of Sponges.— In a memoir on two New Sponges, etc., in the Annals and Mag. of Nat. Hist., Mr. H. J. Carter remarks that he last year confirmed Prof. H. James Clark's discovery of a "collar" round the cilium of the sponge animal, which must now be regarded as the animal of the sponge, as much as the polype is regarded as the animal of the coral.

The animalcule of the sponges is described, in its passive form, as "a minute globular cell, apparently filled with granuliferous plasma, bearing a nucleus and two contracting vesicles, provided with a rostrum or projecting cylindrical portion supporting a delicate fimbriated collar, in the midst of which is a single cilium, and, in its active state, will take into its body crude material (that is, particles of indigo) if they be presented to it. The collar and rostrum possess the power of polymorphism; and, when necessary, the whole body can be thus transformed. The latter is about $\frac{1}{300}$ inch in diameter in the calcareous sponges, and only half that size in those of the siliceous ones that I have examined; and they are arranged in countless groups on the living sarcode of the areolar cavities of the sponge." Of other familiar animalcules this resembles most the Difflugia, a kind of Amæba which throws out its pseudopodia from one particular part of its globular form; and if the zygosis among the Difflugiæ is a true conjugation, there is strong reason for believing any similar union of the sponge animalcules to be of the same nature. Though the author does not positively assert that the zygosis of the Difflugiæ is a means of reproduction, he seems inclined to that belief, partly because that procedure is always confined within the limits of species; and he seems to have traced a corresponding link in the history of the sponges.

Finally, the author, having noticed a tendency to speak more decidedly in microscopical inquiries than our powers seem to him to justify, condemns as unphilosophic the usage of those who call the parts of the lower organisms structureless. A wall or layer may be so dense and conspicuous as to be readily observed and named, yet it would be unphilosophic to call it wanting if only infinitely delicate and therefore imperceptible. The leg of Euplotes is "probably" complicated in its muscular structure, and there are textures in the Spongiadæ, he doubts not, which are distant and misty hints of development, which in the higher animals are recognized by the coarsest sense.

Multiplication of Wheel Animalcules by Budding.—Dr. R. Greef has no difficulty in confirming the asexual reproduction of the Vorticellæ by fission, but reaches a very different conclusion in regard to the formation of the budlike structures which he finds are not buds at all, products of their bearer, but the products of

several times repeated fission of other individuals, which attach themselves from without and thus become united to the larger individuals. Stein has already traced this remarkable process and named it gemmiform conjugation. A full discussion of this process is given in the "Annals and Mag. of Nat. Hist." for June, 1872.

Spicules of Sponges. — Dr. J. E. Gray, in treating of the Classification of Sponges, in the "Annals and Mag. of Nat. Hist.," remarks that the order Coralliospongia presents the greatest abundance and the most diversified forms of spicules. The spicules that form the greater part of the skeleton of these sponges are generally joined together by a siliceous substance. Dr. Bowerbank has repeatedly denied this explanation, and calls them siliceo-fibrous sponges; but the perfect form of the spicules and the thin layered additional siliceous deposit which unites them can be well seen in a section, or in a portion of the skeleton disintegrated by the heat of a spirit lamp.

Some sponges have a fashion of collecting and imbedding in their sarcode spicules which are the remains of other sponges; and therefore care is necessary to determine which spicules really belong to the organism in which they are found. Some species even exercise a selection of certain kinds of spicules for this singular kind of absorption.

Though the form and arrangement of the spicules afford important means of classifying the sponges, the external form is an equally important character which cannot be disparaged, as has been done by some distinguished observers. It is true that some of the species are very polymorphous; but the same is true of some algæ and zoophytes which are still classified with some reference to their general forms.

NOTES.

The twin peaks, known as Torrey and Gray's Peaks, the highest of the Rocky Mountains, so far as yet ascertained (being considerably over 14000 feet), were last summer visited by the discoverer, Dr. C. C. Parry, who first ascended and named them in the year 1862, and by the two botanists whose names he gave to them. A full account of the ascent of Gray's Peak, on the 14th of August last, by Dr. Parry, Dr. Gray, and numerous citizens of Georgetown,

preparation may be kept within it, for days or weeks together, without losing vitality, owing to the simple arrangement for supplying fresh air.

We have repeatedly had the opportunity of witnessing the use of this slide, and are convinced that nothing of the kind has yet been devised which can equal it in excellence, either for observing or generating the lower forms of life.—*Journal Franklin Institute.*

To Blacken Brass.—The following methods are given by anonymous correspondents in the "English Mechanic and World of Science." Though not new they will be useful to readers, who desire to give a dead-black finish to adapters, diaphragms, etc. Warm the brass over a gas flame or spirit lamp, and plunge it while hot for two or three seconds into nitric acid. Then heat again until it blackens, brush off the blisters, and lacquer if a lustrous surface is desired. Instead of the nitric acid the following fluid may be used: a mixture of two parts of arsenious acid, four parts of hydrochloric acid, one part of sulphuric acid, and eighty parts of water.

Monochromatic Sunlight, by Means of Glass Plates.—Mr. J. Edwards Smith, of Ashtabula, Ohio, has obtained light with which he is perfectly satisfied by means of a light sky-blue and darker green glasses. He prefers to use one blue glass combined with two or three green ones, the best shades being ascertained by trial. Several such sets, of different depths of color, may be mounted in a series, like magic lantern pictures, so that either set can be brought easily over the hole in the shutter. By sunlight transmitted through such a combination of glasses, and without condenser or apparatus of any other kind, he "resolves" all the shells of the Probe Platte with perfect ease. He considers the light thus modified as good as the more nearly monochromatic light of the troublesome ammonio-sulphate cell.

An Optical Experiment.—A correspondent of the "Scientific American" thinks the photographic camera might be a means of gaining an unlimited magnifying power. He would photograph an object and then take a series of enlarged views, each one representing on an enlarged scale, a portion of the preceding one. Evidently he is not accustomed to the use of magnifying powers.

Camphor in Paraffin Lamps.—Mr. John A. Perry, of Liver-

pool, calls attention to the fact that about fifteen grains of camphor added to the paraffin in an ordinary sized lamp about an hour before using, will greatly increase the brilliancy of the light.

Mounting Small Objects in Balsam.— A correspondent in the "English Mechanic and World of Science," who has been troubled by the balsam washing away from the centre of the slide small objects, such as starch grains and diatoms, advises that the balsam be placed on the slide in the form of a ring around the object, so as to run in upon it from all sides and not drift it away. A better contrivance is to wet the object and allow it to dry upon the slide, after which it will not easily be misplaced. A trace of gum arabic may be added to the water if, as will seldom be the case, it should be found necessary.

Bone Dust in Soap.— If any kind of soap seems irritating to the skin, particularly the cheaper kinds of "Old Brown Windsor," try the microscope for the detection of fine particles of ground bone which have not been separated from the fat of which the soap was made.

The Fresh Water Polype. — Mr. James Fullagar gossips pleasantly about the *Hydra vulgaris* in "Science Gossip." He has no difficulty in multiplying his specimens by cutting up the animals; though the parts do not lead an equally favored life, for the head-part proceeds to eat immediately, while the stalk is obliged to wait patiently several hours, fasting, until a new head and tentacles are developed. The polypes contracted and dissolved into a confused mass of granules in December. None could be found during the winter, but very small ones appeared in the spring, and still later these assumed a large size and began to multiply by budding. The earliest that appeared, much smaller than those produced by budding, he believed to be produced from eggs, though their origin escaped him, as it had escaped previous observers.

Reproduction of Sponges.— In a memoir on two New Sponges, etc., in the Annals and Mag. of Nat. Hist., Mr. H. J. Carter remarks that he last year confirmed Prof. H. James Clark's discovery of a "collar" round the cilium of the sponge animal, which must now be regarded as the animal of the sponge, as much as the polype is regarded as the animal of the coral.

The animalcule of the sponges is described, in its passive form, as "a minute globular cell, apparently filled with granuliferous plasma, bearing a nucleus and two contracting vesicles, provided with a rostrum or projecting cylindrical portion supporting a delicate fimbriated collar, in the midst of which is a single cilium, and, in its active state, will take into its body crude material (that is, particles of indigo) if they be presented to it. The collar and rostrum possess the power of polymorphism; and, when necessary, the whole body can be thus transformed. The latter is about $\frac{1}{3000}$ inch in diameter in the calcareous sponges, and only half that size in those of the siliceous ones that I have examined; and they are arranged in countless groups on the living sarcode of the areolar cavities of the sponge." Of other familiar animalcules this resembles most the Difflugia, a kind of Amæba which throws out its pseudopodia from one particular part of its globular form; and if the zygosis among the Difflugiæ is a true conjugation, there is strong reason for believing any similar union of the sponge animalcules to be of the same nature. Though the author does not positively assert that the zygosis of the Difflugiæ is a means of reproduction, he seems inclined to that belief, partly because that procedure is always confined within the limits of species; and he seems to have traced a corresponding link in the history of the sponges.

Finally, the author, having noticed a tendency to speak more decidedly in microscopical inquiries than our powers seem to him to justify, condemns as unphilosophic the usage of those who call the parts of the lower organisms structureless. A wall or layer may be so dense and conspicuous as to be readily observed and named, yet it would be unphilosophic to call it wanting if only infinitely delicate and therefore imperceptible. The leg of Euplotes is "probably" complicated in its muscular structure, and there are textures in the Spongiadæ, he doubts not, which are distant and misty hints of development, which in the higher animals are recognized by the coarsest sense.

Multiplication of Wheel Animalcules by Budding.—Dr. R. Greef has no difficulty in confirming the asexual reproduction of the Vorticellæ by fission, but reaches a very different conclusion in regard to the formation of the budlike structures which he finds are not buds at all, products of their bearer, but the products of

several times repeated fission of other individuals, which attach themselves from without and thus become united to the larger individuals. Stein has already traced this remarkable process and named it gemmiform conjugation. A full discussion of this process is given in the "Annals and Mag. of Nat. Hist." for June, 1872.

Spicules of Sponges. — Dr. J. E. Gray, in treating of the Classification of Sponges, in the "Annals and Mag. of Nat. Hist.," remarks that the order Coralliospongia presents the greatest abundance and the most diversified forms of spicules. The spicules that form the greater part of the skeleton of these sponges are generally joined together by a siliceous substance. Dr. Bowerbank has repeatedly denied this explanation, and calls them siliceo-fibrous sponges; but the perfect form of the spicules and the thin layered additional siliceous deposit which unites them can be well seen in a section, or in a portion of the skeleton disintegrated by the heat of a spirit lamp.

Some sponges have a fashion of collecting and imbedding in their sarcode spicules which are the remains of other sponges; and therefore care is necessary to determine which spicules really belong to the organism in which they are found. Some species even exercise a selection of certain kinds of spicules for this singular kind of absorption.

Though the form and arrangement of the spicules afford important means of classifying the sponges, the external form is an equally important character which cannot be disparaged, as has been done by some distinguished observers. It is true that some of the species are very polymorphous; but the same is true of some algæ and zoophytes which are still classified with some reference to their general forms.

NOTES.

The twin peaks, known as Torrey and Gray's Peaks, the highest of the Rocky Mountains, so far as yet ascertained (being considerably over 14000 feet), were last summer visited by the discoverer, Dr. C. C. Parry, who first ascended and named them in the year 1862, and by the two botanists whose names he gave to them. A full account of the ascent of Gray's Peak, on the 14th of August last, by Dr. Parry, Dr. Gray, and numerous citizens of Georgetown,

with other travellers, was published in the "Colorado Miner," edited by the Rev. Professor Weiser, who made an encomiastic address upon the occasion, upon the mountain's summit. The visit of Dr. Torrey was a few weeks later. Gray's Peak being the easier to surmount, is ascended almost every fine summer day from Georgetown; and when a better bridle-road replaces the present rude trail of the last two miles the whole ascent may be made with wonderfully little toil. As Gray's Peak is the one commonly visited, and as it has never received any other name, it has come to have more celebrity than its equally picturesque and perhaps rather loftier fellow, and sometimes the name is applied in the plural number to both culminations, or else the name of Irwin's Peak is used to designate the western one. But it is understood that Mr. Irwin's exploration of this peak was a few years later than Dr. Parry's ascent of both and his dedication of them, one to his botanical master, and the other to Dr. Torrey's associate in publication, Dr. Gray. The citizens of Georgetown, as represented by a numerous deputation, assembled upon this twin mountain upon the occasion referred to, and took the opportunity to do an act of justice, no less than of well deserved compliment, by formally resolving that the original name of the western peak, as assigned by Dr. Parry, ought to be and should be restored; that, as the one is everywhere known as Gray's, the other should in the future, as at first, be known as Torrey's Peak, and so our botanical Nestor be no longer defrauded of the honor which was specially intended for him in the original naming. We wish it could be added that Dr. Torrey had accomplished the ascent of his own beautiful mountain upon the occasion of his recent visit; but unpropitious weather prevented his reaching the summit.

An incomparable distant view of these peaks is to be had from the summit of Mount Parry, which rises between the valley in which Empire City lies and the Middle Park.—A. G.

We regret to announce the death of Professor John B. Perry, which took place at his home in Cambridge, on the third of October, in his forty-sixth year.

Professor Agassiz's stay on the Pacific coast is having good results in awakening an interest in natural science among the people. We notice by the "Sacramento Daily Union" of Oct. 5, which contains a very full report of a lecture by Prof. Agassiz,

and an account of a reception given to him, that steps were taken to organize at once a Natural History Society in Sacramento by Dr. Logan and others.

Among the recent improvements in our colleges for enlarged facilities in science-teaching may be mentioned the new laboratory erected at Colby University, Waterville, Maine, at an expense of $30,000. It is 48 by 56 feet long, and two stories in height. The lower story will be devoted to chemistry, the upper to a museum of Natural History. Provision has been also made to establish a chair of Natural History and Astronomy.

At Bowdoin College also, Hon. P. W. Chandler is to refit Massachusetts Hall as a Natural History Museum, in memory of the late Professor Cleaveland, at an expense of $8,000 to $10,000, the work being partly done. It is hoped that the graduates will take a pride in sending rare specimens of animals, plants and fossils to fill up existing vacancies.

We have received the first number of a new monthly bee journal, "The North American Bee Journal" published by Moore and King, Indianapolis, Indiana. Its appearance indicates the popularity of bee keeping, and while Wagner's "American Bee Journal," published at Washington, is by far the most scientific and ably conducted that we have seen, there is undoubtedly room for more. By the way, when shall we have observations made in this country on the development and mode of growth and habits of the honey bee comparable with those of the best German apiarists? Is it not time for the appearance of an American Dzierzon and Siebold, or must we wait another century? Cannot science and practice among apiarians be united in America as well as in Germany?

A regular meeting of the California Academy of Sciences was held Monday, August 6th. Many valuable specimens of aboriginal skulls, minerals, petrifactions from near Salt Lake City were presented to the Academy.

Mr. Stearns called the attention of the Academy to the death of Major S. S. Lyon of Jeffersonville, Indiana, and referred to the ability and distinguished services of the deceased.

Dr. Blake exhibited a specimen of an apricot which was spotted upon the surface with a blight probably the same which attacks the grape, and further remarked that the peaches and nectarines

this year, particularly in the valley of the Sacramento, appeared to be quite generally affected by it.

Mr. Stearns submitted specimens and a description of a new species of Truncatella, which he had named *T. Stimpsonii;* it differs from the only other species of Truncatella credited to the Californian province in having longitudinal ribs, the other species being smooth.

Dr. Gibbons announced the expected arrival within a few days of Dr. John Torrey and Prof. L. Stone, the latter visiting the coast for the purpose of investigating the salmon in connection with the introduction of the best variety in the rivers of the Eastern States.

The French Association for the Advancement of Science held its first session at Bordeaux, in September, about eight hundred members being present. The association is divided into fifteen sections. Many papers were read and various excursions were made in the vicinity.

The British Association met at Bristol, in August, and though upwards of two thousand members were present, and a goodly number of papers were read, yet there seems to have been some special cause that has led the press to consider the meeting as not so successful as some others. The address of Dr. Carpenter on "Man as the Interpreter of Nature" and Sir John Lubbock's address on the "Origin of Insects," (not yet published) were perhaps the most noteworthy productions of the session.

The Swiss Association of Naturalists (Société helvétique des Sciences) assembled this year at Fribourg, on the 19th, 20th and 21st of August, and met with a hospitable reception from the inhabitants and authorities of the little city. There is no place of half its size in the Confederation but has greater cause to boast the number of its scientific students and yet nothing was left undone to make the meeting successful. On the evening of the 18th most of the visitors had arrived and greeted each other informally in the Tivoli gardens, a public resort just outside the city. The regular proceedings opened the following morning at ten o'clock, when the President, Dr. Thurler of Fribourg,* welcomed the association in a few words, recounted the part Fribourg had played

* The President is apparently selected from the town where the meeting is held.

in the history of Swiss science and drew attention to its public works of scientific interest.

As an appropriate introduction to the scientific communications, Prof. Gilliéron of Basle gave an account of the Fribourg Alps, lying in four concentric arcs between the lakes of Thun and Geneva. He passed in review the successive deposits and gave an admirable sketch, rapid, clear and concise, of their relations to one another, dwelling with especial force on some points of local interest.

Dr. Gros then exhibited a collection of objects of considerable importance belonging to the bronze and stone ages obtained from Locraz, Lake of Bienne, during a recent partial draining of the lake.

M. Favre read a report of progress made in the preservation of the large erratic blocks of Switzerland. The cantonal government assume the protection of these, according as they are recommended by a standing committee of the association.*

The session closed with an account by Dr. de Saussure, of the last eruption of Vesuvius and the consequent changes in the physiognomy of the mountain, illustrated by a map and specimens obtained on a recent visit.

The following day was devoted to sectional meetings, which opened at the early hour of eight. Dr. de Saussure presided over the zoological section, where the first communication was made by Prof. Vogt; he gave a detailed account, accompanied by numerous enlarged sketches, of the transformations of Artemia; special attention was drawn to the fact that in the young, the second pair of articulated members are natatory legs, similar in both sexes, which afterwards become complicated and enormously developed claspers in the male, and abortive organs in the female.

M. A. Forel (who received, at the general session of the previous day, the Schaffly prize for an exhaustive essay on the structure and habits of Swiss ants) gave a very interesting account of the habits of certain ants of mixed colonies; these he divided into classes, the first comprising ants of different species, which live in actual communism and perfect harmony, one as slaves of the other; the second comprising those which sustain a perpetual warfare, the one living in passages mined in the walls of the

* Ought not the state governments to exercise similar jurisdiction over such remains in our own country?

other's formicaries; in this case, sapping is sometimes carried on so extensively as to ruin a portion of the common abode, whence ensues a sanguinary combat, the smaller, weaker mining species only saving itself by taking refuge in narrow passages where the foe cannot follow.

M. Fatio followed with an account of exotic bats which have been known to occur in Switzerland.

Dr. Vouga next read a paper on the Mentone skeleton, and compared the formation of the bone cave where it was found to that of the Grotto of Four, where implements of the stone age have been discovered; he considered the powdery soil of both to have been produced mainly by the incessant fall of flakes of lichen from the ceiling of the cave, and argued from the comparative depth of these deposits that the probable age of the Mentone skeleton was four times that of the implements in the Four Grotto. The same subject was discussed in the geological section, where M. F. Forel maintained that the Mentone Cave relics should be referred to the period of the reindeer, although no bones of that animal had been found in it; he believed the skeleton to be that of an old man, belonging to a wandering tribe of hunters.

The foregoing account embraces that portion of the early proceedings which would especially interest readers of the NATURALIST; but we cannot pass over some other features, suggesting, perhaps, desirable changes in our own plan of procedure. In the first place, the Swiss Entomological Society takes this opportunity of assembling its members. Why might we not still further nationalize our "American" Entomological Society, which never holds a meeting out of Philadelphia?

Again, the eminently social character of this annual assembly is in pleasing contrast with our more formal meetings. The mornings only are given to "papers;" two or three hours each day are devoted to a "banquet" in a large hall, at which the president of the association presides. The annual assessments are made large enough to cover the additional expense and in this instance the wine was provided partly by the "Fribourg section" of the society, partly by the "Conseil d'Etat" of Fribourg. "Vin d'honneur" was the new name given to the Yvorne. Toward the conclusion of the first day's repast, toasts followed in rapid succession. Prof. Vogt favored the assembly with a truly American speech in which "la Liberté" was toasted. In accordance with a suggestion

of Prof. Desor, who recalled the pious custom at ancient festivals of evcking the names of departed friends, all rose in silence at the mention of two most distinguished members, lately deceased — Pictel de la Rive and Escher von der Linth. Dr. Dor greeted the foreign men of science present at the reunion, prominent among whom were Milne-Edwards of Paris and Volpicelli of Rome, and brought the former to his feet amid much applause. Rival cities and rival sections then vied with each other in the interchange of compliments, amid which the hilarity came to an end. All the speeches were voluntary an l none occupied more than five minutes.

After dinner each day excursions were made in the vicinity, where, in some private grounds, an unannounced collation awaited the guests; one evening was spent in the cathedral, listening to the far famed organ; on the other evenings the members assembled in the Tivoli gardens, where supper and music were provided. No ladies were present on these occasions nor were there more than two dozen in attendance in the gallery of the main hall at the opening of the general session.

At the meetings, both general and sectional, hand specimens and microscopic objects were freely exhibited, the members constantly crowding to the platform to examine them during pauses in the remarks, the presiding officer joining with them, until, by returning to the chair, he indicated the wish of the speaker to resume.

Excepting the introductory remarks of the President there were no set addresses whatsoever, in marked contrast with the custom of the British Association, where the president of each section inflicts a labored discourse upon his auditors. Perhaps we have struck the golden mean, but the Swiss custom has much in its favor.

Printed lists of the persons present each day were supplied to all in the evening. Each guest was also furnished, on arrival, with dinner tickets, a guide book and map of the city; lodgings were provided free for any who wished to accept. The meeting next year will be held at Schaffhouse, under the presidency of Dr. Stierlin. — *Special Correspondent.*

The recent Meeting of the American Association for the Advancement of Science held at Dubuque has called forth more criticism than has usually been given to the annual gatherings of this important and truly national body, and much that has been said has been adverse to the meeting in a scientific sense. Though

the association has perhaps deserved a little censure for some of its acts, which it is well thus to check before they take root, yet we think that some of the remarks in the daily press have been made through ignorance of the real work of the association, and the special cause of the supposed failure in the "science" of the recent meeting.

It must be remembered that the association has one great object, as expressed by its name; and science is advanced not only by the discussion of papers and facts brought before the association by laborers in its many departments, but also by meeting first in one section of our vast land and then another, thus bringing the workers of all regions together and, by actual contact, cementing the knowledge of the East, West, North and South into a true American Science; and not only is the cementing process to be accomplished by the reading and discussion of scientific papers by the members, but also by bringing the scientists into immediate contact with the people at large. When we take this broad view, which is, we think, the basis upon which the association was founded, we do not think that any meeting can be called in the least degree a failure because not *all* the brilliant lights of American Science happen to attend, and the papers which are read happen to fall short of the usual number, or fail in presenting startling discoveries and novel facts and theories.

That there was a comparatively small attendance of old members from the eastern and even from the central states was unquestionably owing to the fact that it was generally understood, until almost the last moment, that the meeting would be held in San Francisco, and as the time and expense of attending a meeting there would be far greater than many members could afford, they made arrangements for passing their summer in other regions, giving up all thoughts of going to the meeting this year, and when it was decided to hold the meeting at Dubuque it was too late to change plans made for the summer and prepare papers for reading at a meeting which they had given up all hope of attending. But even this has had a good result, for we think the association, with this experience, will not again leave the place of the next meeting unsettled at its adjournment.

That the Dubuque meeting was in many respects, especially socially, a decided success cannot be doubted; for certainly the greatest interest was evinced by the people of Dubuque and adjoin-

ing places in the objects of the association, and we have seldom seen such hearty good will and fellowship extended to scientists as were given by the citizens and by the great railroad corporations of the west. If appreciation of scientific work by the multitude is one step in advancing science, the results of the last meeting must be considered as most favorable.

Neither can we review the papers received and discussed, and glance over the names of the members present, without feeling that in these respects also the meeting was successful; though admitting that there was not that sharp overhauling of some crude papers which has sometimes taken place to the purification of science. In fact, the only drawback to the meeting was the lack of critical discussion of some of the papers, which were read and allowed to drop without the criticism they would have received at a larger meeting when more persons working in the same field would have been brought together.

The small number of members present (about 188) left several of the subjects which usually have a goodly number of adherents very limited in their support, and though about half of the hundred papers admitted to a place in the programme were referred to the Natural History section, to which we shall confine our remarks. there were not enough to cause the division of the section into subsections, and the bulk of them fell as usual under the head of Geology. In Botany there was but one, and that was the able address of the retiring President, Prof. Gray, which we gave in full in our last number. In Zoology there were the three by Prof. Morse on the "Oviducts of the Brachiopods," the "Embryology of Terebratulina," and "Observations on living Rhynchonella;" the very interesting and carefully prepared paper by Prof. Riley "On a new genus of Tineidæ and the singular connection of the insect with the fructification of the Yucca," which was one of the best papers read in the section; that on "Organic Vigor and its relation to Sex," by Prof. Hartshorne; and one on "Zoological Barriers," by Prof. Orton. In Palæontology, the two papers by Prof. Cope and one by Col. Foster were important in presenting new discoveries; while the paper by Dr. Day on the "Eye of Trilobites," gave an opportunity for a discussion on the position of the Trilobites among the crustaceans.

In Geology, the papers read by President Smith, Messrs. White, Perry, Alex. Winchell, N. H. Winchell, E. W. Hilgard, Andrews,

Hitchcock, Kerr, Cope, Cox and Forshey, presented recent work in the field and laboratory, and were not only in most part ably discussed, but were most instructive résumés of work accomplished and theories advanced. Under this head must not be forgotten the remarks on the recognition of the value of the State Geological Surveys by Prof. Peirce as Superintendent of the United States Coast Survey, which resulted in a memorial to Government calling attention to the desirableness of compiling the results of all the state surveys and publishing them with suitable maps; a most important step for the proper understanding of the geology of the country.

In Anthropology, Col. Foster's paper on the "Crania of the Mound Builders," of which we shall give an abstract in our next number, was the most important, while the short communications by Messrs Woodman and Putnam helped to keep up an interest in this subject. In Microscopy but little was done, though the few microscopists present separated, under the usual subsection, from the Physical section, and had a number of discussions and papers by Messrs. Ward, King, Hilgard, Babcock, Tuttle and Wescott.

The more than usual care with which the Standing and Sectional Committees passed on the papers that were entered on the general list before allowing them a place on the daily programme will be hailed by all members as a step in the right direction. Though a most disagreeable task to perform, it is one that, if carried out to the full extent that it should be as required by the constitution, will do more than any other thing to make the association an exponent of the science of America, and we trust that the example set by the last Standing Committee will be followed next year, so that not only will worthless papers be excluded, but the rule providing for the presentation of abstracts of papers be enforced before allowing papers to go over to the Sectional Committees.

The Committee appointed at the Indianapolis meeting to report if any amendment to the constitution was required regarding membership rendered their report, in which they stated "that they found the constitution fully provided for the points which they had been requested to consider, but that its provisions had been violated, and that they considered a strict adherence to the constitution of vital importance to the association." The clause to which the report was specially directed was that relating to the two classes of members, the active and the associate, and it is under-

stood by the present Standing Committee that the elections next year will be made in accordance with the provision; and it was very generally expressed that all present members should notify the Permanent Secretary as to the position they wish to hold, either as an active or associate member, it being understood that the class of active members was to contain all who were specially interested in scientific work, while the associates were to be those who joined the association for the purpose of attending the meetings in order to gratify their own tastes or to give pecuniary or personal aid in advancing its objects; the only distinction made between the two classes being that the active members alone could hold office or vote on any matter pertaining to the management of the association.

Among the votes passed was one proposed by Col. Foster, the chairman of Sect. B., providing for a classified index of all the volumes of the proceedings, which would render them of much greater value than now.

In the general discussions which took place among the members much was said regarding the importance of having an official report of the proceedings, which should embody all the discussions, printed daily. The accomplishment of this would be a great advantage to the public as well as to the association, and arrangements could unquestionably be made for it by the employment of regular stenographers, which the rules of the association state shall be employed when practicable.

During the session, excursions were made to the lead mines, spar caves, and other places of interest in and about Dubuque, and a very enjoyable trip was made by rail to the "painted rocks" some 80 miles up the river, and continued by boat to the town of McGregor, where the members and friends of the association were most cordially welcomed and provided with a repast, after which they returned by rail to Dubuque. After the adjournment, quite a number of members accepted the kind offer of passes from the officers of the Illinois Central R. R., and were in succession the guests of the citizens of Ft. Dodge, Springvale and Sioux City, receiving at every place the most generous of welcomes, and assisted in securing the special specimens each was after. The writer of this note will never forget the aid and kindness he received while pursuing his ichthyological and archæological researches among the rivers and mounds of Iowa, and he knows that all

others who were on the excursion unite with him in thanking the many friends they made for the true western hospitality extended and accepted.

The twenty-second meeting of the association will be held at PORTLAND, Maine, beginning on Wednesday, AUGUST 20, 1873, and we believe that the association made a most judicious choice in selecting a place not only easily reached from all sections of the country, but one which will offer the extra inducement of a probably cool season, however hot the discussions may prove, and there will not be the 'bugbear' of "too hot a place to go in August" which has prevented many members from attending the western meetings.

The officers elect for the next meeting are *President*, JOSEPH LOVERING of Cambridge; *Vice President*, A. H. WORTHEN of Springfield, Ill.; *Permanent Secretary*, F. W. PUTNAM* of Salem; *General Secretary*, C. A. WHITE of Iowa City; *Treasurer*, W. S. VAUX of Philadelphia; *Standing Committee, ex officio*, in addition to the above officers, J. LAWRENCE SMITH of Louisville, Ky.; ALEX. WINCHELL of Ann Arbor; E. S. MORSE of Salem.

BOOKS RECEIVED.

Ueber die Weizenverwüsterin Chlorops tæniopus und die Mittel zu ihrer Bekampfung. Von Prof. DR. M. Nowicki. Wien. 1871. 8vo. pp. 38.

Die unseren Kulturpflanzen schadlichen Insekten. Von G. Kunstle. Wien. 1871. 8vo. pp. 96.

Die Pflege der jungen bei Thieren. Von G. R. v. Frauenfeld. Wien. 1871. 12mo. pp. 59.

Verhandlungen der K. K. Zoologisch. botanisch. Gesellschaft in Wien. 1871. xxi Band. Wien. 1871. 8vo.

Bulletin Meteorologique Mensuel de l' Observatoire de l' Universite d' Upsal. Vol. i. Nos. 1-12. Dec. 1868 to Nov. 1869. Vol. iii. Nos. 7-12. Juin-Nov. 1871. Upsal, 1871. 4to.

Nova Acta Reg. Societatis Scientiarum Upsaliensis. Series 3. Vol. viii.

Bulletin de la Societe Imp. des Naturalistes de Moscou. 1871. Nos. 3, 4. Moscou, 1872. 8vo.

Abhandlungen herausg. vom Naturwissenschaftlichen Vereine zu Bremen. Band iii. Heft. 1 Bremen, 1872. 8vo.

Monographie des Chrysomelides de l' Amerique. Par C. Staal. Parts i-iii. Upsal, 1862-65. 4to.

Bulletin Mensuel de la Societe d' Acclimatation. Jan.-May. 1872. 8vo. Paris.

Sitzungsberichte der Naturwissensch. Gesellschaft Isis in Dresden. Oct.-Dec., 1871. Jan. to March. 1872. 8vo.

Correspondenzblatt des Zoolog. mineral. Vereines in Regensburg. 25 Jahrg. 1871. 8vo.

Archiv fur Anthropologie. Band 5. Vierteljahrheft 2. Braunschweig. 1872. 4to.

Beitrage No. 1, zu der Abhandlungen des Naturwissensch. Vereines zu Bremen. 1871. 4to.

Memoires pour servir a l' Histoire Naturelle du Mexique des Antilles et des Etats-Unis. Par H. de Saussure. 4me Mem. Mantides Americains. Tome 2me. Prem. Part. Geneve et Bale. 1870. 4to.

Öfversigt af K. Vetenskaps-Akademiens Forhandlingar. 26, 1869, 27, 1870. Stockholm. 8vo.

K. Svenskal Vetenskaps-Akademiens Handlingar Ny Följd. Band vii. Haft 2. Band viii, ix 1868, 1869, 1870. Stockholm. 4to.

Meteorologiska Jakttagelser i Sverige utgifna af K. Svenska Vetenskaps-akademien. Af Er. Edlung. Band ix-xi. 1867-1869. Stockholm. Folio.

Minnesteckning öfver Erik G. Geijer. Af F. F. Carlson. Stockholm. 1870. 8vo. pp. 23.

Lefnadsteckningar öfver K. Svenska Vetenskaps-Akademiens efter aar 1854, aflinda Ledamoter. Band i. Hafte 2. Stockholm. 1870. 8vo.

Sitzungs-berichte der Gesellschaft Naturforschender Freunde zu Berlin. 1871. Berlin. 1871. 8vo.

Zeitschrift fur die Gesammten Naturwissenschaften. Bd. iii, iv. 1871. Berlin. 1871. 8vo.

The Entomologist's Monthly Magazine August. 8vo. London.

Feuille des Jeunes Naturalistes. August 1. Paris. 8vo.

---

* Mr. Putnam will not enter upon the duties of his office, except so far as relates to arrangements connected with the Portland meeting, until next summer, and all communications relating to the past meeting must be addressed to Prof. Lovering.